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[OFFICIAL NOTICE.]

Detroit Meeting, American Gas Institute.

HEADQUARTERS, AMERICAN GAS INSTITUTE,
25 West 39th street, New York, Aug. 20, 1909.

The following preliminary outline of the plans underway for the Detroit meeting of the American Gas Institute may be of interest. The Committee of Arrangements, as appointed by President Prichard, was made up as follows: Irvin Butterworth, Chairman; J. T. Lynn, J. J. Knight, B. O. Tippy, W. T. Barbour, W. S. Blauvelt.

With the approval of the President, Mr. Butterworth has added to the list a number of men prominent in the gas industry. The Sub-Committees are now arranged as follows:

Ways and Means Committee.—James T. Lynn, Chairman; W. T. Barbour, Geo. H. Barbour, James W. Dwyer, John J. Knight, Frank Hulswit, Lazard Kahn, D. J. Collins, J. N. Williamson.

Smoker.—Jules G. Hoffman, Chairman; Alonzo P. Ewing, A. L. Zwisler, F. P. Mueller, Ed. Leaky.

Boat Trip.—V. F. Dewey, Chairman; W. S. Blauvelt, Jas. Foley, Roy Shacklette.

Entertainment of Ladies.—H. L. Olds, Chairman; W. G. Henry, W. R. Vanvalkenburg, Andrew H. Green, Jr., Samuel T. Douglas, W. E. Moss, B. O. Tippy, Stanhope Boal, W. C. Kennedy, George D. Roper, George M. Clark, Charles H. Dickey, A. T. Knowlson

Hotels, Hall and Information.—E. F. Lloyd, Chairman; George Osius, Edward M. Mabcourt, G. O. Ciliax.

The Committee has decided to arrange for an informal "Smoker" at the Wayne Pavilion, instead of a banquet. There will be a theater party, luncheon at the Country Club and trips about the city for the ladies. A steamboat trip to Lake St. Clair, down the river to Bois Blanc, including an inspection of the very interesting engineering work at the new channel, and a visit to the Solvay Process plant, will be features. The headquarters will be at the Pontchantrain, and the meetings will be held at Elks' Hall, only a block distant.

Mr. R. B. Brown, Chairman of the Technical Committee, advises that about 16 papers are being prepared, and that Dr. Hyde has consented to give a lecture on "Illuminating Engineering."

There will be three good papers on commercial sujects, one on "Accounting," one on "Illuminating Engineering in Practical Applications," and a first-class technical and general programme.

The reports from the "Wrinkle Department," "Bureau of Information," and the various committees, will contain matter of unusual interest. Further details, as to hotel accommodations and papers, will be sent out soon.

A. B. BEADLE, Secretary.

[OFFICIAL NOTICE.]

Eighteenth Annual Meeting, Michigan Gas Association.

OFFICE OF THE SECRETARY,
GAS OFFICE BUILDING,
DETROIT, MICH., August 11, 1909.

To the Members of the Michigan Gas Association: All arrangements have been completed for the 18th Annual Meeting of the Michigan Gas Association, to be held aboard one of the large D. & C. boats, leaving Detroit, September 14th, at 9 A.M. The boat will comfortably accommodate 250. All reservations for staterooms must be made promptly in order to secure accommodations. The tickets, including the berth, all meals, in fact, all expenses from the time the boat leaves Detroit until its return, are $22 each; $3 extra if a stateroom is to be reserved for one person.

This ticket includes the annual dinner and all entertainment features. The following programme has been arranged:

"How We Sold Our Surplus Coke," by Mr. Glenn R. Chamberlain, Secretary, Grand Rapids (Mich.) Gas Light Company.

"Study of Firebrick," by Mr. V. F. Dewey, Engineer, Detroit City (Mich.) Gas Company.

An informal talk by Mr. H. M. Wilson, Chief Engineer of the Technologic Branch, U. S. Geological Survey, Washington, D. C., whose "talk" will be on the "Purchase of Coal."

"Retort Benches," by Mr. A. S. B. Little, Engineer, St. Louis, Mo.

"Illuminating Engineering Problems with Gas," by Mr. Norman Macbeth, Manager of Illuminating Engineering Laboratories, Welsbach Company, Gloucester, N. J.

The sessions have been so arranged that it will give you ample opportunity to see the beautiful scenery of the St. Clair river, the beautiful scenery of the St. Mary's river, and 3 or 4 hours will be reserved at the Soo for inspection of the locks. There will be 3 or 4 hours on Mackinac Island.

Staterooms may be reserved any time prior to September 1st by the deposit of $10.

Any reservations not made prior to September 1st must be made on board the boat the morning of the 14th of September.

Circular, giving full information, may be had by applying to A. P. Ewing, Secretary, Gas Office Building, Detroit, Mich.

Very truly yours,
ALONZO P. EWING,
Secretary and Treasurer.

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[NOTICE.]

Experience Division, Pacific Coast Gas Association.

PACIFIC COAST GAS ASSOCIATION,
OFFICE, EDITOR OF EXPERIENCE DIVISION,
LOS ANGELES, CAL., August, 1909.

To the Members, Pacific Coast Gas Association:

"Gas Bag:" "Why is the Experience Department Like a Divorce Scandal?"
"Leaky Pipe:" "Give It Up."
"Gas Bag:" "The Experience Department relates to painful Experiences, but a divorce scandal is a painful experience to relatives."

Be that as it may, what the Experience Department hath brought together let no man tear asunder. Every year we have our sanctified, purified and illuminating union; and it is a union of affinities. Two hearts may beat as one; but no man can beat experience as a teacher. What, then, can so efficaciously teach the gas man as this wedding of Experiences, chaperoned, purified and solemnized by the Editor of the Experience Department? Preparations for the ceremony are now underway, and we need your assistance. Send in your experiences. Speed them along. Brook no delay. Almost any old thing is eligible, and no family names are betrayed. Fall in line: The wedding march is sounding. Fraternally yours, R. P. VALENTINE, Editor.

[NOTICE.]

Wrinkle Department, American Gas Institute.

WRINKLE DEPARTMENT, AMERICAN GAS INSTITUTE,
OFFICE OF EDITOR, GAS OFFICE BUILDING,
DETROIT MICH, March 12th, 1909.

To the Members, American Gas Institute: All members of the American Gas Institute are earnestly requested to forward contributions for the Wrinkle Department as soon as possible.

Your co-operation determines the success of the Department.

F. L. CROSS, Editor.

BRIEFLY TOLD.

THE GAS RATE AT PORT HURON AND THE LAW.—For some time, in fact, since November, 1905, the authorities of Port Huron and the proprietors of the Port Huron Gas Company have been at odds over the gas rate that may be charged there. In order to make the history of the case plain it may be stated that, in November, 1907, the Company's charter expired by limitation, prior to which periods, and, since then, in fact, for a term of perhaps four years, the proprietors have endeavored to secure a working franchise without any practical result. The selling rates therefor (or, say, in 1907) were $1.40, gross, less 15 cents, net, per 1,000 on illuminating account, the supply on heating, cooking and power account being $1, gross, less 20 cents for prompt payment. Repeated appeals to the Mayor and the City Council for a governing ordinance, in which rates should be named, in behalf of the Company having virtually been disregarded, the proprietors determined to force the issue. Accordingly, the first of last month, notification on general account was given that, beginning at once, the Company would charge a gross rate of $1.25 per 1,000, with 25 cents off for prompt payment, such rate to apply on whatever amount of gas was used. This did not suit the authorities at all, for forthwith an action was started by the city to enjoin the Company from putting the named schedule in force. The action was brought in the Circuit Court for the county of St. Clair, the city of Port Huron appearing as plaintiff against the Port Huron City Gas Company as defendant, and the relief sought for was in the nature of a temporary injunction. The burden of the city's plaint was the contention that the proposed rate was "unreasonable and exorbitant." In opposition the Company pleaded a reasonable rate, and portrayed the neglect of the authorities to report or agree upon a fitting governing ordinance. The case was argued before Byron B. Erkins, Circuit Judge of the 16th Judicial Circuit, but acting in this instance as of the 31st Judicial Circuit. His decision in the premises is appended—which, from our point of view, positively foreshadows the fact that the recalcitrant city fathers of Port Huron will frame up a governing ordinance with "reasonable rapidity." His Honor writes:

Complainant seeks a temporary injunction against defendant to restrain it from charging consumers a rate for gas which it is alleged is unreasonable and exorbitant.

Defendant's franchise expired in November, 1907, and it has operated its plant since that time apparently by tacit consent Some efforts have been made to obtain a new franchise, but the parties have not been able to agree upon its terms. It is conceded that the non-existence of a franchise shall not affect the question here presented.

The rates heretofore charged by defendant to its consumers were $1.40 per 1,000 cubic feet for illuminating gas, less a discount of 15 per cent. if paid within 10 days, and $1 per 1,000 cubic feet for fuel gas with a discount of 20 per cent. if paid within 10 days. The rate now proposed is a $1 flat rate, for both fuel and illuminating gas, and it is this proposed rate that is attacked as unreasonable.

It is conceded that the Court has not the power to fix the rates to be charged by defendant Company to its consumers, but has the authority, on a proper showing, to say whether the rate proposed is or is not unreasonable.

Assuming, then, that it may be inferred from the bill of complaint that the proposed rate increases the cost of gas to the consumer, a point I do not determine, the question remains whether there is sufficient showing of unreasonableness to entitle complainant to the relief prayed.

The Court may not say arbitrarily that a given rate is unreasonable. What may be reasonable under certain conditions may be unreasonable under others. The question involves a consideration of the amount of money actually invested in the enterprise, the gross income, the operating expenses, the fixed charges and fair dividend on the capital stock, etc.

The only showing made by the city is by its bill of complaint verified by the Mayor. While it may be presumed that he is fairly conversant with the affairs of the city, it will hardly be assumed, without some showing to that effect, that he is so intimately acquainted with the affairs of the Company as to safely express an opinion on this subject. If he has such knowledge, he should set forth sufficient facts from which he makes his deductions. What dividend he would regard as unreasonable upon the capital stock of the Company, does not appear. Minds may differ upon this matter and, as the case is presented at this time, the Court must take, in order to issue the injunction, the conclusion of the complainant that the rate to be charged is exorbitant without knowing upon what facts the opinion is based or how the conclusion is arrived at. On the showing made, I do not not feel justified in allowing the writ. The application is therefore denied.

CURRENT MENTION.—

WORD from San Francisco under date of the 2d inst., is to the effect that the September convention of the Pacific Coast Gas Association, which is to be held in San Francisco the 21st, 22d and 23d insts., will be at least as successful as any of the 16 now on record. If such be the case, and we have no reason whatever for posing as a doubter in respect of the news, the coaster gas men have surely a good time before them.

IN further connection with the Coasters, it may be mentioned that a notable and representative number of the gas men of the Pacific country, the central point of which, in this instance, is Los Angeles, Cal., have determined to strain every point to have the 1911 meeting of the American Gas Institute held in Los Angeles, and the actual canvassing on this account will be commenced at the Detroit meeting next month of the Institute. On that occasion a special delegation from the Coast will be on hand to urge the movement. Mr. Joseph M. Berkley, Managing Engineer of the Domestic Gas Company, of Los Angeles, who is our informant respecting this movement, among other things, writes this mention: * * * "If we receive sufficient encouragement from the inquiries sent out we will attend the Detroit convention armed with an invitation which will require considerable bombarding on the part of other cities contesting for the convention in 1911. We believe in beginning in sufficient time, therefore, we are taking this means of advising our friends of our hopes and desires."

THE Evens & Howard Firebrick Company report that bench orders were recently received from the named places: Two benches, rear clinkering type of 6's, for Norfolk, Va.; 2 benches, front clinkering type of 6's, for Crandfordsville, Ind., and a refill at Bowling Green, Ky. The Company has made arrangements to build the new gas plant at Collinsville, Ills., which plant will start with 2 benches of inclines of the Little type. The contract also calls for the furnishing of the rest of the apparatus, such as exhauster, scrubbers, washers, condensers, steel purifiers and a storage holder. The Collinsville proposition is being supervised by Mr. Thomas Fox, who was formerly in charge of the Cape Girardeau (Mo.) gas, electric and water systems. Messrs. Evens & Howard are contractors for the complete plant.

The Varied Utilization of Gas Lamp Posts.

[Communicated by "R."]

One marvels when he surveys the many and various uses to which the common gas lamp posts and other forms of lighting posts are put. In former years it was considered sufficient to have the United States mail box fixed to the lamp posts of the city or town, and the letter carriers found it convenient to have mail collecting and mail delivering boxes bolted with clamps and brackets to the corner lamp posts. As years went by the fire department commenced to utilize the lamp posts for fire alarm boxes, signal boxes and for like purposes. For years the lamp posts were restricted in use to mail boxes and fire alarm boxes, and then the plan of fixing the titles of the streets to the corner posts was introduced. This proved of considerable benefit to strangers in town; the signs were arranged on stencilled metal work so that the light could project through the letters, making the title readable in the dark.

But the utilization of the city and town lamp post is very different now. Some of the lamp posts in the public parks are curious to look upon because of the various devices attached thereto. In some of the pay-as-you-enter summer entertainment parks you will find common lighting posts, resembling christmas trees, as a result of the ornamentation of devices attached thereto. You will find numerous lamp posts used for advertising purposes in a careful and neatly planned way, and you will find some posts so liberally covered with cheap advertising matter that the effect is quite the reverse.

Probably one of the best sources of income from the lamp post, when used for purposes other than lighting, is where the post is employed for purposes of advertising. There are lamp post advertising companies in existence now, which companies will pay quite a tribute to the city or town treasurer for the exclusive use of the park, street, or all of the lamp posts of the municipality. The company draws up a chart, covering all of the posts thus leased, and sublets the same in districts, or rents parts of posts in certain public locations. Posts located near where there are theaters and many persons always bring high rentals for advertising purposes. Isolated lamp posts are usually not availed of at all. Posts situated directly in front of certain stores are frequently sublet by the company to the store people for advertising purposes. Very often quite elaborate plans are made to advertise in this way. Fig. 1 shows one of the advertising tops in readiness to adjust to a lamp post. If the affair had been rented out to a shoe dealer, advertising matter on all sides of the lamp post will read accordingly; if for hats and caps, the signs will be lettered to advertise the head gearing and so on. The soda fountain people believe in this type of advertising and usually put in one or more combinations of this order. Sometimes the gas arc advertising managers put their trade-mark on a part of the combination, so as to draw attention to the name of the firm and location, just as we often see in the street car, "The advertising space in this car is controlled by, so-and-so." Since the general use of the exceedingly bright gas arc lights, the problem of effective advertising with street lamps has been rendered easy.

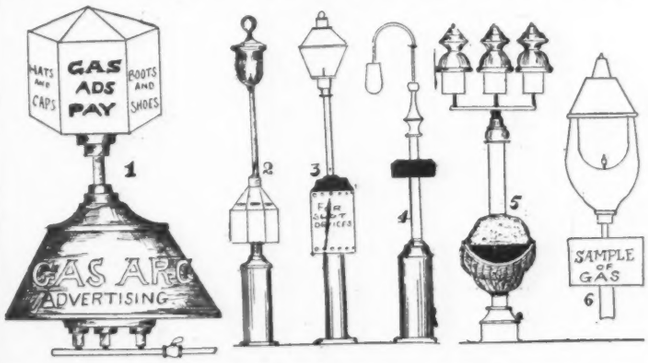
The old-fashioned systems of lighting offered no encouragement for advertisers to utilize lamp posts for advertising purposes; the lights were too dim. Street light advertising results from the improved lights now in use, and the persons engaged in the business report there is a bright prospect for this style of advertising.

The lamp post of to-day is also employed, in certain business and industrial sections, for supporting express and similar order boxes, as in Fig. 2. The authorities derive an income by charging a moderate rental to all parties who have their call boxes attached to the city posts. Sometimes a company will lease the lower portion of the posts for order box sub-letting and do quite a business without interfering with the upper portion of the posts where the advertising matter is supported. Then, again, telephones, in incased apartments with public toll attachments, may be seen fixed securely to the lamp posts in certain cities and towns. Although the slot machines are in disfavor in most places, licensed devices of this order can be found adjusted to lamp posts, as in Fig. 3. In some of the Western cities the penny gum and peanut self-selling devices abound.

Index signs are never out-of-place on lamp posts. It is the practice to put up neatly cut, sheet metal signs, with the printing plain and clear. The sign is usually riveted or strapped to the post, as in Fig. 4. The clamped sign is the best, as it can be removed more readily. Often one will observe many signs on a single post. The street may be designated, and there may be index signs of this way to the entrance, exit, drinking water, etc.

With the introduction of the two, three, four and five lamp system, many new factors have been introduced in conjunction with lamp posts. The drinking fountain, as in Fig. 5, is, of course, but the application of an old principle. Still the project is carried on in a more up-to-date way in the present age. Some of the fountains are ornamented extensively, and there are often metal trimmings of a costly character. The bright night-light makes the water below sparkle and attract the water-drinking public. Stands of this sort may be seen in the public parks in many enterprising cities, and has been the means of giving the decorated lamp post men much business. Some of the men interested in the introduction of lamp posts in the public grounds of cities state that business is often obtained on the basis of samples or models of just what can be done with the lamp posts when properly designed and fitted for public service. Photographs are also exhibited, and on the bases of these views the public park commissioners often place some very attractive and profitable orders with manufacturers and designers of lamp posts.

Then you will occasionally find a lamp post out in front of gas works, or lamp post makers, or gas arc designers, presenting the merits of sample gas, sample lamp, sample posts, etc., as in Fig. 6.



The people are given an opportunity to see just what can be done with gas when utilized under approved conditions, with a modern type of lamp and approved pattern of lamp post.

[Concluded from Page 629.]

The Comparative Values of Various Coatings and Coverings for the Prevention of Soil and Electrolytic Corrosion of Iron Pipe.

[A paper prepared by Mr. Robert B. Harper, for the Illinois Gas Association.]

Results of the Porosity and Resistance Tests.

On account of the great number (over 600) of samples, a complete description of the final condition of each sample submitted to the porosity and resistance tests would probably lead to considerable confusion concerning its respective merit as compared with others. Therefore, each kind of protective material which was tested is described in somewhat general manner, as follows:

Cremo.—Cremo, as a rule, turned brown and changed from a glossy to a dull surface, upon immersion in water, pure or otherwise, showing that it was probably acted upon. It was susceptible to action by dilute sulphuric acid which decomposed it rapidly with the formation of minute blisters. Cremo showed slow deterioration in the oxidation test and was acted upon slowly by cinder, loam and clay soils. This first named soil had the most destructive effect, as evidenced by the decrease in insulation resistance, and the "alligatoring" (similar to Fig. A, Plate I.), where the coating had been alternately exposed to the action of the air and soil water. It also showed deterioration in lake water by passage of electrical currents under low voltage (1.5 volts). A microscopic examination of coating revealed a smooth, black surface, containing no holes or crevices in the part which had been exposed to the atmosphere alone, while the portion which had been covered by distilled water showed areas resembling coke in their porous appearance.

Annapolis Mixture.—Annapolis mixture showed also immediate deterioration (see Fig. D, Plate I.) in the presence of the dilute sulphuric acid. Of the soils, cinders produced the greatest damage. It lasted fairly well in relatively pure waters, such as distilled, gas saturated, and lake waters. Ammonia did not produce much de-

terioration, but electrical currents, under low voltage, passing to or from the coating immersed in lake water, resulted in considerable decrease in insulation resistances and the formation of some blisters which broke, allowing corrosion of metal to take place.

The microscope revealed the fact that a coating of Annapolis mixture, which had been immersed in distilled water, possessed areas resembling the pores of coke, and also that a number of clear-cut, minute holes, of from .001 to .004 inch in diameter. The unwetted areas were smooth and without crevices or holes.

TABLE IV.—*Resistance in Ohms Observed in Soil Tests on Various Coatings.*

No. of Sample Pipe.	Dry and Uncovered by Soil.	After 48 Hours in Wet Soil.	After 72 Hours in Wet Soil.	After 120 Hours in Wet Soil.	After 168 Hours in Wet Soil.	After 216 Hours in Wet Soil.
1	2,000,000 or over....	980	550	134	165	173
2	" " "	500	390	214	172	274
3	" " "	3,800	37	14.2	10	9
4	" " "	166	150	54	54	75
5	" " " ...	2,960	84	29	25.4	12.6
6	" " " ..	720	650	600	350	325
7	" " " ...	0.18	0.19	14.4	15.6	12.4
8	" " "	0.5	0.52	0.17	0.16	0.17
9	" " " ...	2,940	71	18	9	17.7
10	" " "	189	100	59	61	99
11	" " "	2,920	44.6	8.8	6	13.6
12	" " " ...	158	129	92	88	135
13	" " "	0.5	0.17	4.42	6.32	14.4
14	" " "	55.2	62.5	107	88.5	87
15	" " "	26,500	8,750	1,900	1,850	1,750
16	" " " ...	95,000	40,000	3,500	3,500	3,700
17	" " " ...	41,000	21,000	3,200	1,900	2,100
18	" " "	75,000	23,500	3,400	3,000	3,000
19	" " " ...	35	8	7.8	7.8	25
20	" " "	0.15	0.16	0.15	0.16	0.15
21	" " "	1,800	151	120	107	86
22	" " "	260	108	96	124	246
23	" " "	112	40	19	20.4	35
24	" " "	170	117	86	88	152
25	" " " ...	5,850	1,100	780	720	680
26	" " " ...	3,700	2,900	1,500	1,140	1,500
27	" " " ...	6,750	680	310	270	238
28	" " "	28,000	6,250	4,000	2,460	2,400
29	" " "	4,560	245	73	51.8	66.5
30	" " " ...	1,200	1,060	430	298	370
31	" " "	4,000	550	179	132	95
32	" " " ...	7,000	1,600	810	665	1,000
33	" " " ...	182	108	45	43.6	41.6
34	" " " ...	236	195	127	108	163
35	" " "	111	110	30	26	58
36	" " " ..	131	101	58	51	59
37	" " "	81	23	9.3	9	15.3
38	" " "	117.5	87	45	45	65
39	" " " ...	0.18	0.43	0.25	0.21	0.17
40	" " " ...	7.8	18.8	12.8	13.7	13.4

Dr. Angus Smith's Mixture.—Dr. Angus Smith's mixture had a tendency to run somewhat at ordinary temperatures. It turned brown after the manner of most tar coatings, and deterioration took place with the greatest rapidity in the presence of sulphuric acid and hydrogen peroxide. It showed up relatively well under the other conditions of soil water and low voltage currents. Microscopical observations failed to reveal any serious differences between the smooth black portion above the distilled water and that part which had been covered by same.

Red Lead Paint.—Red lead paint was, like the preceding coatings, most susceptible to deterioration by sulphuric acid, which apparently converted some of the red lead to lead sulphate, resulting in the formation of large blisters containing gas under the paint film. Loam, cinder and clay soils reduced its imperviousness to water. It gradually deteriorated under all conditions, but showed fairly good staying qualities in the presence of strong brine, probably due to the formation of insoluble salts and rust in the voids of the paint film. It was affected by the passage of electrical currents.

Sarco Pipe Dip No. 15.—Sarco pipe dip, No. 15, showed deterioration under nearly all conditions imposed. The acid solution caused by the most rapid increase in permeability. In general, the greatest deterioration of this coating seemed to occur where the dip was alternately exposed to the action of the air and solution. The usual manner of failure seemed to be the formation of rust beneath the covering, resulting in the rupture of the coating. When viewed under the microscope, the sample which had been immersed in distilled water showed that the smooth black surface exposed to the atmosphere only, bore considerable contrast to the portion which had been immersed. At the water line mark there were numerous blisters (about .005 inch in diameter) cracked at the top, and some of the submerged part showed areas resembling sponge rubber in appearance.

Concrete.—Concrete showed almost immediate and large decreases in the insulation resistance in practically every case. The acid solution had a disintegrating effect upon the concrete, which usually dropped from over 2,000,000 to about 10,000 ohms resistance between areas of 1 square inch and 1 inch apart.

Ebonite.—Ebonite gave decreases in insulation resistance under nearly every test condition. The deteriorating effect of the dilute sulphuric acid was almost immediately apparent. The general manner of failure seemed to be brought about by minute blisters, which were found to be present in many cases. The appearance of this coating was good even when it showed considerable porosity after the action of clay, cinder and loam soils. Magnification of the sample which had been immersed in distilled water, showed a smooth, unbroken surface over the unwetted areas, while below the water line the portion which had been submerged presented to view numerous minute, unbroken blisters about .004 inch in diameter.

Carbonkote No. 1.—Carbonkote No. 1 rapidly deteriorated in nearly all test solutions. The dilute sulphuric acid and the cinder soil seem to quickly cause failure. Decreases in the resistance of the coating were recorded under practically every condition. The general failure seemed to be by blistering and flaking. Under the microscope, a few relatively large ruptured blisters (.50 inch in diameter) were found on the test sample which had been subjected to distilled water. In addition, numerous minute holes, about 1-5000 of an inch in diameter, were discovered.

Crysolite.—Crysolite showed gradual signs of failure under many of the conditions imposed. In most all cases the coating presented a fairly good appearance to the naked eye. The deterioration seemed to be by a pitting action. It seems to have been susceptible to cinder soil, but scarcely so toward the clay or the loam soil. It compares favorably with the previously described dip films of the same thickness. Microscopical examination revealed, in submerged portions, areas of apparently porous structure similar to that of cremo and Annapolis mixture.

Voltax No. 105.—Voltax No. 105 apparently decomposed in the presence of water. In all but the acid solution, the coating became opaque and white. Voltax seemed to be somewhat more resistant to action of dilute sulphuric acid than to the alkaline cinder soil, or to the ammonia solution, in which the deterioration took place with the greatest rapidity. The usual failure of this coating was apparently due to general decomposition of same to a white, spongy film resembling, under the microscope, wet snow.

Acid Fume Proof Paint.—Acid fume proof paint resembled other tarry coatings in the change of its surface to a dull brown color where the solutions had wetted it. The cinder soil, sulphuric acid, hydrogen peroxide, sodium chloride and low voltage currents were found to affect it considerably. Distilled water and ammonia did not deteriorate this paint to any perceptible extent. Nearly every failure was accompanied by the formation of minute, crater-like pits. Under the microscope, that surface of coating which had been exposed to the air only was smooth and unbroken, but those areas which had been submerged in distilled water showed a number of crevices about .005 inch long and an abundance of minute holes about 1/10 as wide.

Depew's No. 1.—Depew's No. 1, showed decided decreases in insulation resistances under every condition tried. It held up best in distilled water. Minute blisters were observed on nearly every sample covered with Depew's No. 1, and flaking of coating was also noticed on several. The microscope showed that while the air exposed section of the coating tested in distilled water was smooth and without crevices or holes, yet that portion which had been submerged appeared to be covered with minute blisters. These blisters were mostly unbroken, but those at the water line were ruptured.

Mogul Electrical Compound.—Mogul electrical compound was, like many of the other coatings, quite susceptible to the action of the cinder soil constituents and sulphuric acid. The strong brine solution was rapid in its damaging effect, which indicated itself by rapid decreases of insulation resistance and the formation of blisters which contained considerable rust. This protective material showed a few microscopic hummocks in the coating. However, the solution and air portion of the sample, which had been immersed in distilled water, showed up much the same, namely, as a smooth, black surface.

TABLE V.—*Condition of Electrolysis Test Samples.*

Sample Pipe No.	Duration of Test in Mos.	Condition of Paint. Dip, or Base.	Condition of Wrapping Material.	Condition of Pipe Under Covering.	General Remarks.
1	7	Paint entirely gone.		Badly pitted and corroded.	
2	7	Paint entirely gone.		Very badly pitted and corroded.	Pipe seemed covered with lampblack.
3	7	Traces of paint on pipe.	Cloth rotten.	Rusty and minutely pitted.	Flakes of rust beneath coating.
4	7	Traces of paint on pipe.	Cloth rotten.	Rusty and minutely pitted.	Flakes of rust beneath coating.
5	1*	Portion of paint gone.	Tar paper very brittle.	Badly rusted.	Covering quite non-adherent.
6	1*		Tar paper very brittle.	Badly rusted.	Covering quite non-adherent.
7	7	Most of paint remaining.		Covered with rusty pits; badly corroded.	
8	1*	Most of paint remaining.		Covered with rusty spots.	
9	7	Paint apparently gone.	Cloth in fair condition.	Pitted under line of seams. Slightly rusty.	
10	7	Paint apparently gone.	Cloth rotten, brittle.	Pitted slightly under seams.	
11	7	Paint apparently gone.	Paper fairly tenacious.	Pitted slightly under seams.	
12	7	Paint apparently gone.	Paper fairly tenacious.	Pitted very slightly.	
13	7	Dip entirely gone.		Very badly pitted and corroded	
14	1*	Dip somewhat brittle			
15	7	Dip gone on top side.	Cloth rotten and saturated with rust.	Badly corroded in one or two spots.	Coating fairly adherent but gone in spots.
16	7	Dip gone on top side.	Cloth rotten and saturated with rust.	Corroded in one spot.	Coating fairly adherent but gone in spots.
17	7	Dip ran considerably. Cellular structure under paper.	Tar paper fairly adherent. Paper torn readily.	Corroded in spots.	
18	7	Dip ran considerably. Cellular structure under paper.	Tar paper fairly adherent. Paper torn readily.	Corroded very slightly.	
19	1*	Paint decomposed.		Badly rusted.	
20	1*	Paint decomposed.		Badly rusted.	
21	1*	Paint decomposed.	Cloth in fair condition.	Rusted badly especially under seams.	Covering not very adherent to pipe.
22	1*	Paint decomposed.	Cloth in fair condition.	Rusted badly.	
23	7	Paint decomposed.	Tar paper in fair condition	Corroded badly under seams in general.	Covering quite adherent in spots.
24	7	Paint decomposed.	Tar paper in fair condition	Corroded badly under seams in general.	Covering quite adherent in spots.
25	7	Good condition.	Paper in good condition.	No apparent corrosion.	Covering extremely adherent to pipe.
26	7	Good condition.	Paper in good condition.	No apparent corrosion.	Covering extremely adherent to pipe.
27	7	Dip apparently gone.	Paper rotten and gone in spots.	Corroded badly in spots.	
28	7	Dip apparently gone.	Paper rotten and gone in spots.	Corroded in spots.	Covering in better condition than No. 27
29	7	Paint apparently gone.	Paper rotten and gone in spots.	Corroded in spots.	Paper very tenacious in spots.
30	7	Paint apparently gone.	Paper rotten and gone in spots.	Corroded in spots.	Paper very tenacious in spots.
31	7	Paint entirely gone.	Paper rotten.	Corroded.	
32	7	Paint entirely gone.	Paper rotten.	Corroded very badly.	
33	7	Paint decomposed.	Paper brittle. Flaked off	Corroded very badly.	Covering flakes like silicious enamel.
34	7	Paint decomposed.	Paper brittle. Flaked off.	Corroded slightly.	
35	1*	Paint brittle.		Corroded with many rust pits.	
36	1*	Paint apparently gone.	Cloth rotten.	Rusted badly.	Covering non-adherent.
37	7	Paint apparently gone.	Cloth rotten.	Corroded badly.	
38	7	Paint apparently gone.	Cloth rotten.	Corroded badly.	
39	7	Paint almost entirely gone.		Corroded and pitted very badly.	
40	7	Paint almost entirely gone.		Corroded.	
41	7	Coating practically all gone.		Corroded and pitted very badly.	
42	7	Coating practically all gone.		Corroded and pitted very badly.	
43	7	Dip brittle. Flaked off readily.		Minutely pitted on upper side.	
44	7	Dip brittle. Flaked off readily.		Corroded very slightly.	
45	7	Dip hard.	Paper in fair condition.		
46	7	Dip hard.	Paper in fair condition.	Apparently not corroded.	Covering very adherent.
47	7	Almost all coating flaked off.		Apparently not corroded.	Covering very adherent.
48	7	Almost all coating flaked off.		Slightly corroded.	
49	7	Dip soft in spots.	Paper readily tears.	Pitted.	Covering quite adherent in spots.
50	7	Dip soft in spots.	Paper readily tears.	Pitted.	Covering quite adherent in spots.
51	3	Dip very brittle.		Corroded badly.	
52	3	Dip very brittle.		Corroded badly.	
53	3	Coating about half gone.		Corroded badly.	
54	3	Coating about half gone.		Corroded badly.	

TABLE V.—*Continued.*

55	6	Concrete hard and dense.		Rusty and traces of corrosion.	Blue green stain in concrete around pipe.
56	6	Concrete hard and dense.		Rusty and traces of corrosion.	Blue green stain in concrete around pipe.
57	6	Traces of paint remaining.	Cloth in poor condition.	Traces of corrosion under seams.	Covering fairly adherent in spots.
58	6	Traces of paint remaining.	Cloth rotten.	Traces of corrosion under seams.	Covering fairly adherent in spots.
59	6	Traces of paint remaining.	Cloth in poor condition.	Pipe in fair condition.	Covering quite adherent to pipe.
60	6	Traces of paint remaining.	Cloth in poor condition.	Pipe in good condition.	Covering quite adherent to pipe.
61	6	Paint decomposed to black powder.	Cloth rotten. Saturated with rust on under side.	Corroded.	
62	6	Paint decomposed to black powder.	Cloth rotten. Saturated with rust on under side.	Corroded badly.	
63	6	Dip practically all gone.		Corroded slightly.	Covering diffused into soil around pipe.
64	6	Dip practically all gone.		Corroded slightly.	Covering diffused into soil around pipe.
65	6	Coating decomposed		Corroded and pitted badly.	
66	6	" "		" " " "	
67	6	Traces of dip remaining. Sticky areas.		Corroded in spots.	
68	6	Traces of dip remaining. Sticky areas.		" "	More dip remaining than on No. 67.
69	6	Dip left pipe on top side.	Cloth rotten in spots.	Slightly corroded in spots.	Dip blistered on under side of covering.
70	6	Dip left pipe on top side.	Cloth in fair condition.	" " "	" " " " "
71	6	Thin film of dip remained.		Pipe in fair condition.	Diffused somewhat into soil.
72	6	Thin film of dip remained.		Pipe in good condition.	" " " "
73	6	Dip left pipe on upper side.	Cloth rotten in many spots.	Corroded in several spots.	Dip blistered and diffused into soil.
74	6	Dip left pipe on upside.	Cloth rotten at seams.	Pipe in good condition.	" " " " " "
75	6	Coating still remains	Cloth rotten.	Corroded very badly.	Covering flaked off.
76	6	Coating blistered and pitted.	" "	Corroded badly.	
77	6	Coating decomposed on top side.	" "	" "	Covering reduced to dark brown powder in several spots.
78	6	Coating in good condition.	Cloth in good condition.	Pipe in excellent condition.	
79	6	Paint hard and white on upper side.		Corroded in spots.	Paint on under side red and saturated with rust.
80	6	Paint hard and white on upper side.		Corroded very slightly.	Paint very adherent in spots.
81	6	Dip cracked, flaked off.		Corroded slightly.	Coating retains some of original elasticity.
82	6	Dip cracked, flaked off.		" "	Dip not very adherent.
83	6	Coating not very adherent.		Pipe in fair condition.	
84	6	Most of coating remaining.		Corroded slightly.	Coating peeling off; blistered and brittle.
85	6	Dip apparently decomposed.	Felt completely decomposed.	Corroded.	Covering reduced to brown powder.
86	6	Dip apparently decomposed.	Felt completely decomposed.	"	
87	6	Paint cracked, shriveled, peeled and flaked off.		Corroded slightly in spots.	
88	6	Paint brittle, flaked off.		Corroded.	
89	6	Dip practically gone.		Slight corrosion.	
90	6	Thin, adherent coat remains.		Pitted in several spots.	
91	6	Dip left pipe on top side.	Cloth rotten.	Pitted minutely.	
92	6	Most of the dip remains.	Cloth in poor condition.	Corroded slightly.	
93	6	Dip mostly gone.		" "	
94	6	Dip flaked off easily.		Pipe in good condition.	

NOTE—*These samples were subjected for about 1 month to the action of soil constituents only. No artificially induced differences of potential existed.

Mogul Repairing Compound.—Mogul repairing compound showed no evidences of decreasing insulation resistance under all conditions imposed upon a number of samples, but it was inclined to be rather non-adherent and somewhat brittle. Microscopical observations gave only slight additional knowledge concerning a very slight action in the form of very minute surface pittings upon those parts of the coating which had been subjected to the action of various solutions.

Carbonkote No. 100.—Carbonkote No. 100 did not do well under most of the imposed conditions. Its usual mode of deterioration was by means of the formation of numerous blisters, large and small, which in most cases contained water, but remained unbroken except where exposed to air and solutions. Magnified sections of the unaffected paint film appeared as a gray-black, lumpy coat, while those of the parts which had been immersed in water showed a porous structure like coke.

Ohmlac No. 1.—Ohmlac No. 1 was most readily broken down by dilute sulphuric acid. It gave constantly decreasing insulation resistances under nearly every condition, except distilled water and loam soil. Minute blisters seem to have been formed in nearly every case.

Tar Coating Mixture.—Tar coating mixture did poorly under all

conditions. It "alligatored" badly and failed in a number of cases by the formation of minute pits in the coating. Under the microscope the air exposed sections of the tar coating mixture were found to be smooth and without holes of any kind, but those parts which had been submerged in water were found to possess relatively large crevices and craters (about .005 inch in diameter) where decomposition had taken place.

Sarco Cold Field Coating.—Sarco cold field coating did well in many instances. It lasted comparatively well under the action of cinder soil and dilute sulphuric acid, but eventually became porous and of lower insulative resistance. This coating held up its resistance fairly well under low voltage electrical currents, but the surfaces had become dull in appearance and showed a slight tendency to blister. The microscope revealed a number of small, shallow pittings, or portions of coating which had been subjected to the action of water.

Sarco Railroad Special Coating.—Sarco railroad special coating gave results which were perhaps a trifle better than the preceding. It, however, showed a tendency to crack and flake off when acted upon by sulphuric acid or strong brine solution. This protective material retained its high initial resistance in nearly every case. It showed evidence of ultimate failure, however, when viewed under a microscope, where minute, unbroken blisters, hardly .001 inch in diameter were found, together with a general slightly porous appearance of submerged as compared with air exposed parts, which were very smooth.

Ohmlac K 35.—Ohmlac K35, maintained throughout the test its initial appearance, whether viewed by the naked eye or by the microscope, and also showed no decrease in insulative resistance under the action of all solutions in which it was immersed. It has the disadvantage of brittleness.

Black Monarch Dip.—Black monarch dip underwent little drop in resistance, except in the presence of the dilute sulphuric acid and the ammonia solution. This coating, however, showed a tendency to shrink or draw away from the metal. It also seemed to become more or less spongy at the surface and, on the whole, showed evidences of ultimate deterioration under most conditions. Microscopically considered, the film which had been exposed to distilled water showed a slightly roughened appearance and retained a few crater-like pits about .005 inch in diameter.

Red Monarch Dip.—Red monarch dip in many respects resembled black monarch dip in its general behavior under various conditions. Most of the solution produced a white film, of apparently decomposed constituents, upon each submerged surface of this coating. Red monarch also showed a tendency to crack and wrinkle. Magnified portions of the coating, which had been immersed in distilled water, had an appearance strongly resembling the crater-covered surface of the moon.

Cleefite.—Cleefite was susceptible to deterioration by dilute sulphuric acid and the sodium chloride solution. It showed evidences of failure through the formation of crater like pits and its tendency to "alligator" at the water line of several of the samples. Upon the whole, it gave results which make it somewhat superior to the red or black monarch dips.

Cremo Pitch.—Cremo pitch gave good results in solutions except that of the dilute acid where its insulation resistance suffered a rapid diminution, and that of lake water when travered by low voltage (1.5 volts) electrical currents. Microscopically considered, cremo pitch showed evidence of deterioration even in distilled water, where submerged parts of the coating were found to possess a few crevices of about .002 or .003 inch in length.

Water Gas Tar Pitch.—Water gas tar pitch maintained its insulative resistance, and hence its imperviousness to water, under all conditions except immersion in dilute sulphuric acid, in cinder soil, and in lake water, where electrical currents under a low pressure passed through it. On the whole, it was a trifle less enduring than cremo pitch. Distilled water apparently had little effect upon water gas tar pitch according to a microscopical examination.

Cremo No. 2.—Cremo No. 2 resembled Cremo No. 1 in its general ability to resist deterioration. However, it was somewhat less efficient as a protection against corrosion by sulphuric acid, gas saturated water and electrolysis.

Resistance Pipe Coating.—Resistance pipe coating did well under all conditions except the dilute sulphuric acid immersion where its insulation resistance slowly decreased with no change being apparent to the naked eye, and the treatment with sodium chloride solution which, after 2 months, caused the formation of small blisters over the entire submerged surfaces. It showed a tendency to be somewhat brittle. The microscope revealed no change from the initial appearance of a sample when same had been immersed in distilled water for considerable time.

St. Louis Mixture.—St. Louis mixture gave fairly good results under all adverse conditions which were imposed. However, the surfaces in many instances showed evidences of deterioration gradually taking place.

Cremo No. 3.—Cremo No. 3 showed fewer evidences of deterioration than cremo No. 1. It maintained its original insulation resistance in all cases for over 2 months, but seemed destined to failure by the pitting and wrinkling which took place on several samples. Under the microscope areas, especially those at the water line, had the appearance of coke and possessed minute holes about .0005 of an inch in diameter.

Cremo No. 4.—Cremo No. 4 gave good results under all conditions and betrayed little evidence of deterioration or porosity by either microscope or porosimeter.

Texaco.—Texaco, in general, was a comparatively resistant coating to the action of all solutions except that of the dilute sulphuric acid, which apparently caused the dip to become brittle and crack. Distilled water had little effect upon it, as proven by a microscopical examination.

Coal Tar Pitch, 600° F.—Coal tar pitch, 600° F., withstood all deleterious conditions nicely and gave little evidence of ultimate failure other than a tendency to be somewhat brittle. No evidences of an effect upon this coating by immersion in distilled water was discernible under the miscrope.

Coal Tar Pitch, 700° F.—Coal tar pitch, 700° F., came through all porosity and resistance tests in first class shape. No evidence of deterioration by any solution was apparent, neither by the naked eye nor by the microscope. Its greatest drawback seemed to be brittleness.

Water Gas Tar Pitch, 700° F.—Water gas tar pitch, 700° F., did not give very good results, partly owing to its failure to cover metal with a uniform coat. It showed evidences of deterioration by wrinkling and allowed corrosion of metal to take place at thinly coated spots.

Mineral Rubber Pipe Dip, 250° F.—Mineral pipe dip, 250° F. did better than the sarco pipe dip No. 15, partly due to the greater thickness in the coatings applied to the samples. It showed the most rapid increases in porosity and consequent decreases in the insulation resistance when immersed in the dilute sulphuric acid and the salt solution. Deterioration was manifested in both cases where electrical currents were caused to flow to and from the coating which was immersed in lake water. The usual failure seemed to be by means of small blisters. Microscopically considered, this coating showed evidences of failure due to small crevices which were discovered upon those parts that had been immersed in distilled water.

California Refined Asphaltum.—California refined asphaltum did comparatively well under all conditions imposed except that of dilute sulphuric acid, which caused a decrease in its insulation resistance. This protective material showed little evidence of decomposition upon a surface that had been exposed to distilled water. Much of the actual data obtained during the porosity and resistance tests has been deemed the most valuable of all, and is given in concentrated form on Charts B, C, D, E and F, which give the approximate resistance of a circular square inch section through the two paint films and metal of any one sample.

Those samples covered with protective paints, dips, etc., which do not appear on the previously mentioned charts, were found to maintain, after a 70-day test, an insulation resistance, as measured by the apparatus shown in Plate IV. of over 2,000,000 ohms (the limit of graduations on the ohmmeter).

In general, it was found, as might be expected, that practically pure water, namely, distilled water, had the least effect of any of the solutions upon the porosity and resistance test samples. Water which had been saturated with the constituents of carburetted water gas had, as a rule, a slightly greater effect than distilled water in reducing the insulation resistance of various coatings and coverings. In most cases lake water and clay soil water had about the same power to increase the permeability of protective materials to water. Cinder soil waters, as compared with those of clay and loam soils, had the greatest effect upon paints and dips.

Black fiber paper was even more rapid than the foregoing in its reduction of insulation resistance.

Wet loam soil caused considerable decrease of insulation resistance of coatings in many instances, and was, next to cinder soil water, the

most destructive of all soils. Immersion in the dilute sulphuric soil solution resulted in the most rapid failures of the coatings and coverings of any of the treatments with the various solutions.

TABLE VI.—*Approximate Costs of Protective Materials.*

Preservative compounds.—	Per Gallon.
Cremo	$0.35
Dr. Angus Smith's mixture	0.10
Annapolis mixture	0.08
Red lead paint	1.30
Sarco pipe dip, No. 15	0.20
Ebonite	0.80
Carbonkote No. 1	1.25
Crysolite	0.75
Voltax No. 105	2.00
Acid fume proof paint	0.90
Depew's No. 1	0.35
Mogul electrical compound	1.00
Mogul repairing compound	2.90
Ohmlac No. 2	0.40
Tar coating mixture	0.15
Sarco cold field coating	1.00
Sarco railroad special coating	0.67
Ohmlac K35	0.06
Black monarch pipe dip	0.85
Red monarch pipe dip	1.55
Cleefite	0.65
Cremo pitch	0.10
Water gas tar pitch	0.05
Cremo No. 2	0.30
Resistance pipe coating	0.35
St. Louis mixture	0.10
Cremo No. 3	0.10
Cremo No. 4	0.10
Texaco	0.15
Coal tar pitch, 600° F	0.10
Coal tar pitch, 700° F	0.11
Water gas tar pitch, 700° F.	0.05
Mineral rubber pipe dip, 250° F.	0.20
California asphaltum	0.10
Wrapping materials.—	**Per 100 Square feet.**
Buckskin manila paper	$0.10
Muslin cloth	0.85
Tar paper	1.00
White fiber paper	0.10
Black fiber paper	0.10
Rubberized felt	2.00

Of the solutions, ammonia ranked next to the acid as a destructive agent. As a rule, hydrogen peroxide affeoted most those coatings which were believed to be susceptible to oxidation. The sodium chloride solution reduced, in many cases, the insulation resistances of the coatings and coverings, and caused considerable rust to be deposited underneath and in the pores of the protective materials. Coatings and coverings, when merely immersed in lake water, were found to deteriorate much slower than when electrical currents under low voltage (about 1.5 volts) were made to pass from or to them while immersed in the same water.

It was observed that iron surfaces retaining their natural black oxide coating and covering with no loose scales, rust or foreign material, compared favorably with those cleaned by acid, as regards their use as foundations for the application of preservative materials. Rusty surfaces, however, were found to be particularly damaging to overlying coats of paint or dip. In most tests, rusty surfaces forced the paint films from the ferric article, and in the case of dips applied hot to rust covered samples, it was noted that the hydrated oxides gave np their moisture and filled the coating material with bubbles.

Buckskin manila paper appeared to be, generally speaking, the most durable paper of those tested. It retained its strength better under all adverse conditions than did the others. When wet, its resistance, as determined by the porosimeter, averaged about 500 ohms. Muslin cloth, of course, had no great insulative value after becoming wet. It averaged about 250 ohms per square inch when moistened with various solutions. Tar paper showed a good insulation resistance when tested after a few minutes' immersion in various solutions, but after a few days its insulative power was reduced to an average of several thousand ohms per square inch.

White fiber paper was much more porous than buckskin manila paper, and a section of 1 square inch, when tested as usual through one thickness of the paper, as were all other wrapping materials, gave, after a short immersion in various soil waters, about 400 ohms resistance. Rubberized felt proved to be quite porous and, when tested in the usual manner after soaking for a short time in soil water, showed an average resistance of a trifle over 300 ohms. In general the physical properties of the wrapping material seemed to change considerably after immersion in the various solutions. Sulphuric acid has the greatest effect in deteriorating the materials.

Results of the Volatility and Oxidation Tests.—The results of the volatility and oxidation tests consisted merely of a collection of data. They have been carefully plotted, as shown in Chart G, where the variation in weight of a number of the coatings is shown by means of curves. The majority of the dips are not shown in these curves, as they changed weight but slightly.

Discussion.—A detailed discussion of the comparative values of various pipe coatings, for the prevention of soil or electrolytic corrosion of iron pipe, could only result into an expansion of this paper into one or more books. Much has already been written upon the subject, more remains to be said, and most, perhaps, remains to be conjectured. The subject is one upon which much data should be secured before any prognostications regarding the life of any given coating are permissible.

It would be rash presumption upon the part of any writer to attribute to any given coating all of the virtues which a protective material must possess in order that it be an efficient preventative of soil or electrolytic corrosion. No preservative paint or dip was found which might be considered a panacea for all of the ills to which metallic structures fall heir. Many of the so-called preservatives of iron or steel may be compared to a number of patent medicines that are said to prevent or destroy the diseases of ferric bodies in much the same manner that "cure alls" are advertised as the deadly foes of the ailments that beset human bodies.

Much data has been accumulated, concentrated and given by means of figures, plates and charts in this paper. The evidence is all in. Let us endeavor to ascertain what preservative materials are favored by the preponderance of the evidence. It has been demonstrated that pipe coatings, as a general rule, are subject to more or less rapid decrease in their resistance to the passage of electrical currents or increase in their permeability to soil waters. This is due partly to the following facts: (1) that the paint or dip used may initially contain minute voids or bubbles; (2) that the protective base itself may decompose; and (3) that many methods of application, although apparently giving perfectly covered pipes, may in reality fail to properly coat the metallic article in an efficient manner.

As a result of the test data obtained and the observations made upon various preventatives of corrosion, it seems probable that few types of covering can withstand the effects produced by high (100 volts) differences of potential between the covered pipe and the surrounding soil waters. Even comparatively low (1.5 volts) potential differences existing over a protective coating have been found to cause decided deterioration of the paint or dip. This ultimate failure of a pipe coating is doubtless more rapid with a high than with a low degree of pressure tending to drive electrical currents through it. Large potential differences result in a heating effect, in addition to the usual electrolytic phenomena, which in soft dips is sufficient to melt same. Even low voltages were found to cause a perceptible, but not particularly dangerous, heating effect upon coated samples immersed in lake water. In view of these and other facts which have been noted during all the tests, it seems extremely doubtful if many of the coatings and coverings tested would last any great length of time under very adversed service conditions.

It is true that a number of sample pipes came through the electrolysis test without showing any great evidence of corrosion on the surface of the metal, but we must not neglect to note the final condition of the protective material which, in numerous instances, was on the verge of failure as a preventative of corrosion. A few of the sample pipes, however, were in good condition at the end of the electrolysis test. For instance, take sample pipes Nos. 25 and 26 (see Table V. and Plate VII.). These were coated according to the St. Louis method, in which coal-tar-pitch-lime mixture alternates with four wrappings of paper. Sample pipes Nos. 45 and 46 (see Table V. and Plate X.) were in fair condition at the end of the electrolysis test. These test pieces were covered in a similar manner to pipes Nos. 25 and 26, the only difference being in the substitution of cremo for the coal-tar-pitch-lime mixture. Other samples more or less approached the foregoing in point of endurance of coating and absence of corroded spots on pipe. A large number of samples withstood the electrolytic actions in clay soil, but deteriorated badly in cinder soil. Most all wrapping materials showed a decided tendency to rot. Muslin cloth seemed most susceptable to decomposition, while perhaps buckskin manila paper gave the least evidences of deterioration. As a whole, many of these coatings and coverings, which broke down in the electrolysis test, would doubtless add considerably to the

length of life of a pipe placed under milder conditions. In all fairness we must not judge comparative values of the preservatives entirely by their actions in the electrolysis test.

Soils of a clayey or argillaceous nature seem to play an important part in the preservaton of a coating, by forming a tenacious mass around the protective material and preventing the ready movement of moisture or electrical currents through the pasty clay, which, in the electrolysis test, hung as an adherent, hard (more or less), dry accumulation around the sample pipe.

A careful comparison of these sample pipes which were buried to clay soil, with those covered by cinder soil, together with the relatively high resistances of clay shown on Chart A, will serve to validate the preceding statement. Soils which are quite porous, and allow ready access of waters carrying deleterious electrolysis in solution, are doubtless very damaging to pipe coatings and coverings. It will be noted, from data obtained in this paper, that paints which give thin films, say from .001 to .003 inches in thickness, are practically useless as preventatives of electrolysis. This is partially due

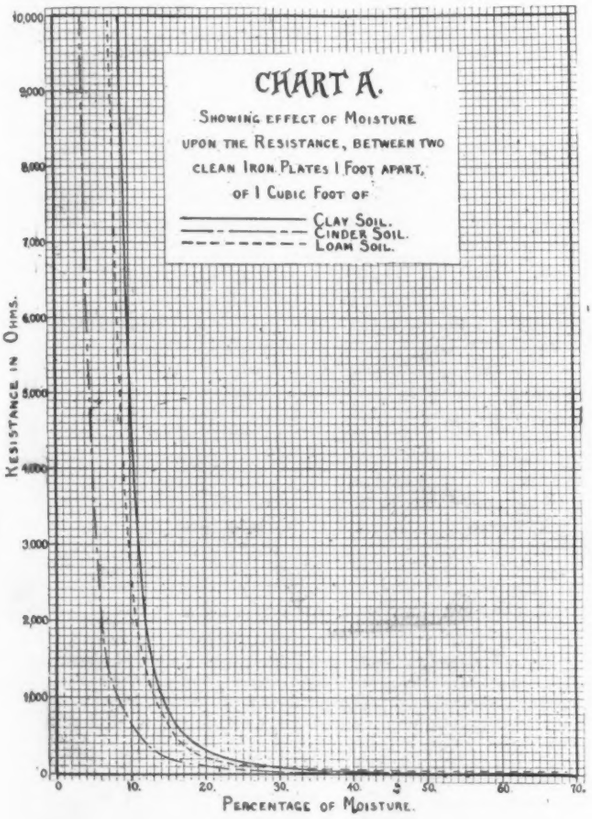
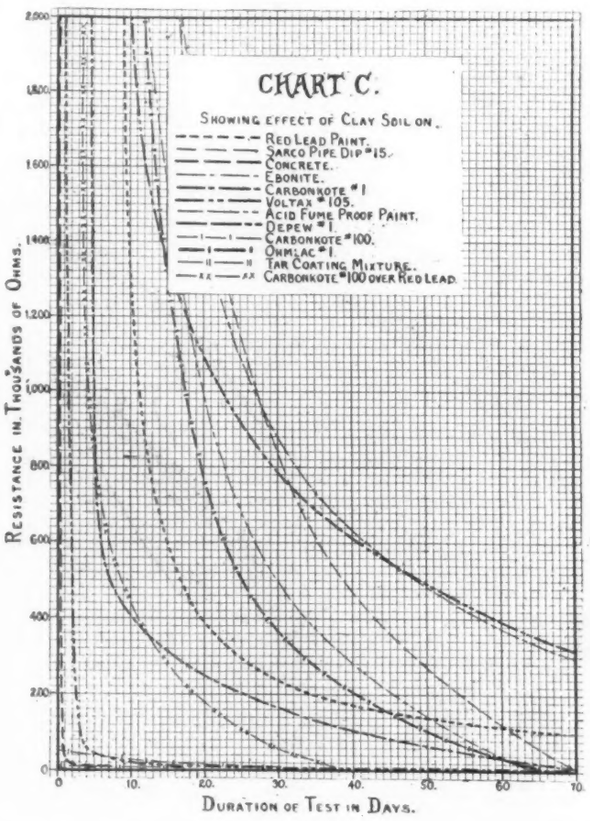
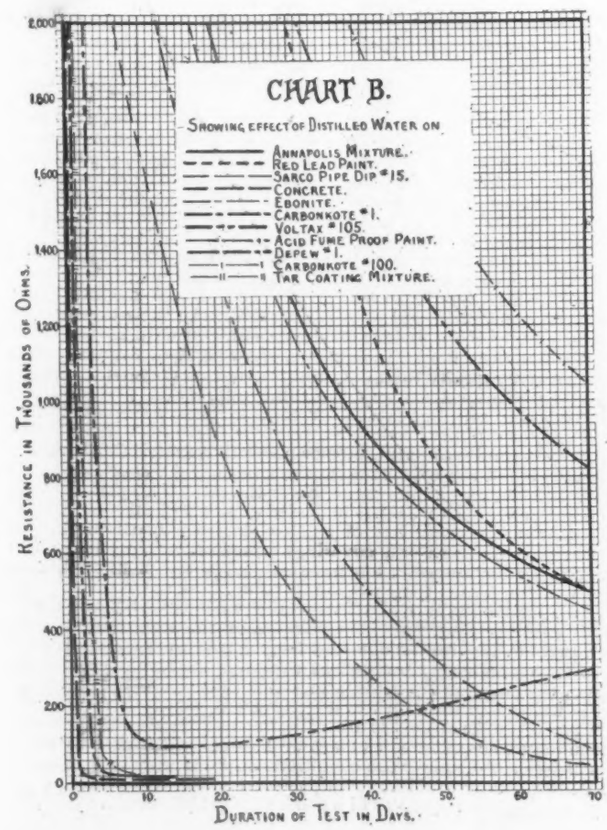
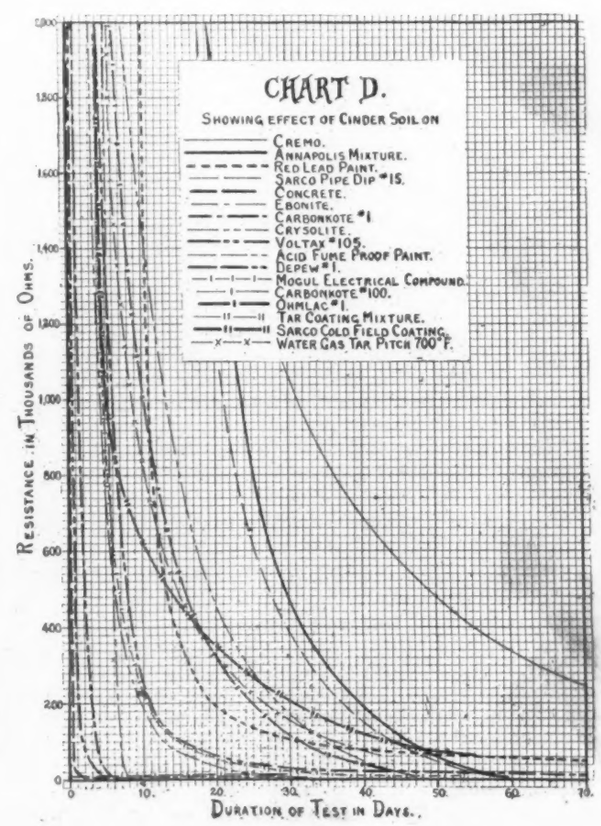
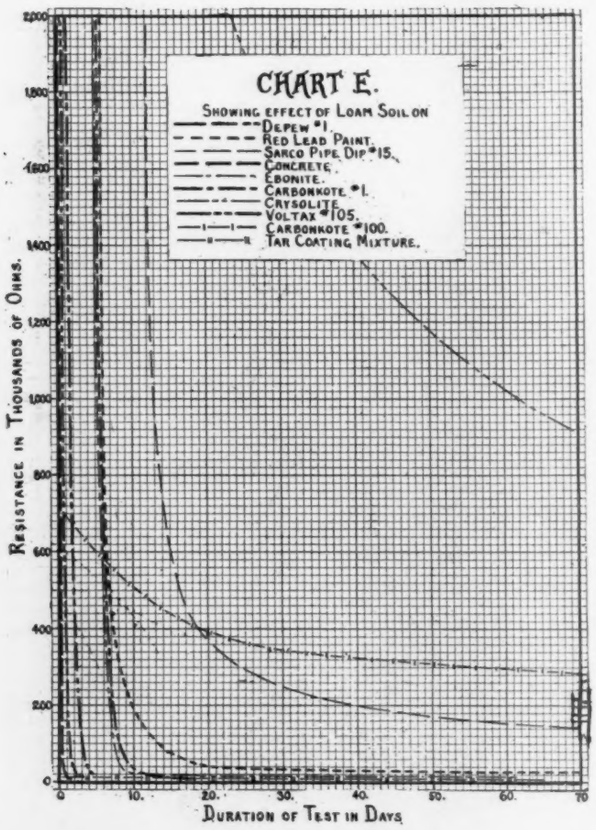


CHART A.
Showing effect of Moisture upon the Resistance, between two clean Iron Plates 1 Foot apart, of 1 Cubic Foot of
Clay Soil.
Cinder Soil.
Loam Soil.
Resistance in Ohms.
Percentage of Moisture.









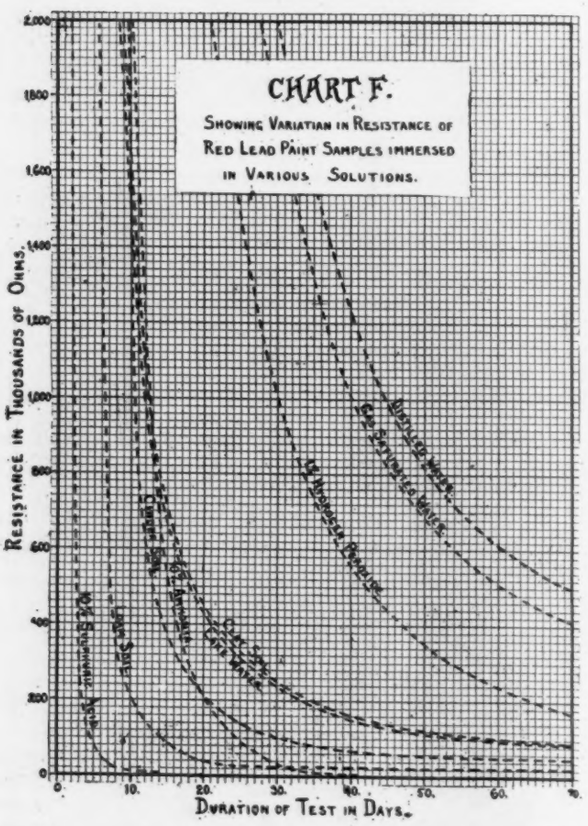
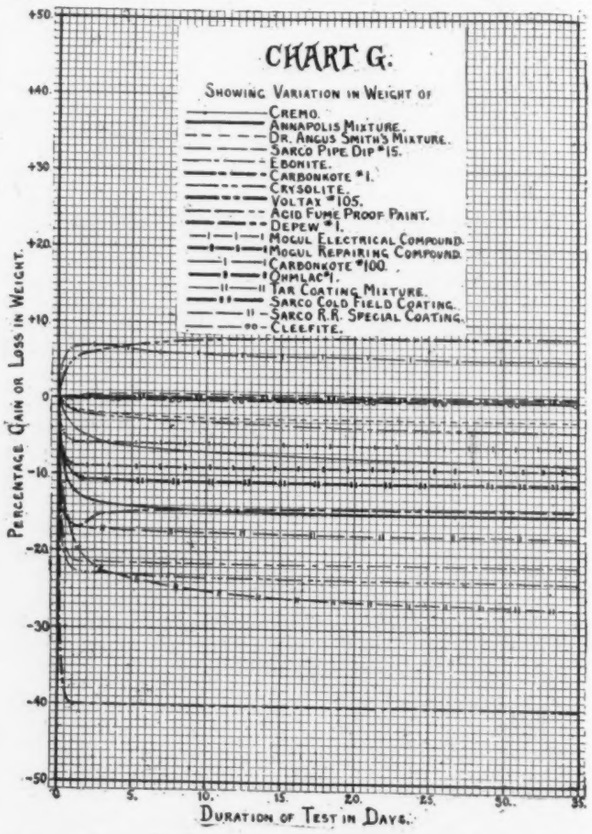


CHART F.
Showing Variatian in Resistance of Red Lead Paint Samples immersed in Various Solutions.
Resistance in Thousands of Ohms.
Duration of Test in Days.

to the thinness and to the properties of the constituents. Thick paints give better results. Dips, as a rule, give the best results.

Those protective compounds which contain little volatile matter are applied hot, and are baked on the pipe; in other words, that class of coatings described in Class 2, under the heading "The Types and Functions of the Coatings and Coverings," seems to offer metallic structures the best practical protection against soil or electrolytic corrosion.

Coatings, such as black oxide of iron, produced by the Bower-Barff process, metals or alloys, and siliceous enamels, may greatly add to the life of a pipe under ordinary atmospheric or soil corrosion, but, with the possible exception of siliceous enamels, afford little protection against electrolysis. The writer experimented with a number of siliceous coatings or enamels which were fused upon the pipe, but was unable to produce satisfactory test pieces. The enamels which are fused on at high temperatures are not very practical coatings for water or gas pipes, as they are expensive, difficult of application, are subject to cracks and flaking, only protect the main body, and cannot be applied in the field. Concrete of itself does not offer any solution, as it is usually readily permeable to water.



Wrapping materials, in general, add nothing directly to the insulative character of a given coating, and the best that can be said for them is that they aid in holding the material in place when subjected to knocks which would, under other circumstances, cause an abrasion or expose the metal.

Referring to Chart B, we find that 11 out of 36 paints, dips or other coatings showed a determinable decrease in resistance or increase in porosity during a 70-day immersion of the resistance and porosity test samples in distilled water. All others maintained a resistance, as ascertained by the porosimeter, of over 2,000,000 ohms. In the case of carbonkote No. 1, it was found that the formation of rust in the paint pores tended to slightly increase the resistance.

Clay soil (see Chart C) caused a somewhat more rapid deterioration of 12 coatings and coverings than did the distilled water.

Comparing Chart C with Chart D, we find that the latter gives us the curves of 17 different pipe coatings showing their decreases in resistance under the influence of cinder soil. It will be noted that a greater number of paints, dips, etc., show signs of failure, and these with greater rapidity than did those buried in clay. Loam soil (see Chart E) deteriorates about the same number of preservative materials as clay soil, but those affected at all seem to have deteriorated with greater rapidity.

All test samples of paint, dips or protective materials the behavior of which is not represented upon the Charts B, C, D or E, had resistances of 2,000,000 ohms or more under the conditions stated. Among these latter samples we must logically expect to find some which excell others as preventatives of soil or electrolytic corrosion. Many of the pipe coatings and coverings excelled or equalled others in some respect or property, but were subject to one or more disadvantages which lessened their all-round value.

In all justice to the manufacturers of various paints and dips, it is but fair to state that, had the thickness of the test samples covered been greater, the results obtained for the insulation resistance might have been greater. However, as the methods employed, the thickness of the paint or dip films, and other data have been given, and as the writer can state that every effort was made to secure smooth coatings of uniform depths on all samples, the results actually obtained may be considered as more or less comparative for such samples as described, under the conditions imposed.

In endeavoring to select some protective base which gave promise of possessing the requisites of a good, efficient preservative, the writer

has endeavored to make all due allowances for the variation in value due to the thickness of the various films of paint or dip. With the facts as observed before us, the element of cost may be considered in our final estimate.

A comparison of costs of protective materials given in Table VI., with their general behavior under all conditions, leads one to the conclusion that, all things considered, paints or dips containing coal tar, or its products as a base, furnish the most practical solution of pipe protection against soil or electrolytic corrosion. They appear cheapest as well as the most efficient compounds, while other manufactured products, such as elaterite and asphaltic dips, are, no doubt, good in some cases, yet, to judge by the samples submitted and tested, they are prone to failure on account of their tendency to become brittle, and to the apparent presence in them of small amounts of matter readily dissolved or decomposed by soil waters. Pure coal tar pitches do not seem to contain any constituents which are readily dissolved or decomposed by soil waters, but, of course, they may be open to the same objection, namely, brittleness, if not properly prepared.

Coal tar products usually cling to pipe better than the majority of dips on the market. Coal tar pitch also seems to be, of all dips, the least affected by oxidation. Its unchanging character in soil waters has been satisfactorily established in many cases. A most striking example of the durability of coal tar pitch is quoted from the *Engineering News*,[1] which tells us that after 32 years the coal tar pitch that had been used as a waterproofing over the old N. Y. C. and H. R. R. R. tunnel still retained its initial properties. It must be remembered that coal tar is a heterogenerous mixture of compounds, some of which must be removed before it is used as a base for pipe coating. It is also subject to considerable variation in composition, and any statements herein made are general and apply to average conditions or compositions. The coal tar pitches used in this test work were said to be a mixture of the by-products of over a dozen different coal gas plants. In light of this fact, we must assume that the results obtained are what might be reasonably expected from an average coal tar or its products.

The discovery of an absolutely efficient material and method for preserving pipes from electrolysis seems to be remote possibly at the best. The writer feels that, were he to propose some good preservative and practical manner of coating service pipe, he could not feel assured that it would do more than delay the ultimate corrosion of a pipe subject to the action of stray electrical currents. Even if the protective compound could withstand the strains naturally put upon it, it seems likely that in practice it would fail of its purpose. The old saying, "A chain is no stronger than its weakest link," was never used more relevantly than when applied to a pipe coating or covering. Too much stress cannot be laid upon the necessity for the proper application of even a fair protective material. One bare spot in a line of apparently covered pipe only concentrates the whole corrosive effect of stray currents, and in reality probably causes the formation of a hole to the interior of the metallic body in a shorter time than if the pipes had been uncovered. It behooves us, therefore, to employ careful workmen and competent inspectors in coating service pipes either at the foundry, at the shop or in the field.

"What is worth doing at all is worth doing well." Let this be the motto of all men engaged in coating pipe, and with the advent of better coatings and perhaps less violent electrolytic conditions, we may reasonably expect to prolong the life of our underground metallic structures indefinitely. As a result of an impartial consideration of all of the preservative materials, their properties, costs of application, and behavior under all conditions, the most practical and efficient (if well applied) type of covering which suggests itself is that of a clean coal tar pitch, free from water, acids or soluble mineral matter. Such a pitch should be as hard as it is possible to make it without having a decided brittleness at ordinary temperatures. It should not crack when struck a hard blow. Pipes upon which such a coating is to be placed should be smooth, free from moisture, rust and loose scale or foreign matter of any description. Burrs or other projections of metal should be filed down before coating pipe, as these if left would, when surrounded by wet soils, probably provide a means of egress for possible stray currents.

The clean pipe should be left in a melted bath of the pitch until the metal and dip are at the same temperature, which should be just sufficient to melt the pitch to a uniformly liquid condition. The pipe when removed should have a smooth, uniform, black, glossy coating, free from lumps, bubbles or foreign matter. The film of pitch should have a thickness of at least 1-32 inch to give a firm coating. If the coated pipe will be subjected to the likelihood of abrasions due to rough handling, it may be found profitable to wrap the cold coated pipe with an overlapping strip of a tough yet flexible paper, or even with a cloth strip (it was found that cloth or paper apparently remained in good condition when saturated or covered with coal tar pitch containing no other foreign substances) and reimmersing wrapped pipe in a slightly softer pitch only long enough to saturate and coat the paper or cloth. The object of this procedure would be to provide a flexible exterior coating to protect the harder underlying layer. Coal tar pitch can also be used as a field coating. The foregoing coating, if used, would probably cost for labor and material about as follows: For covering one hundred 14-foot lengths of 2-inch pipe in one 100-hour day, the approximate cost would be as per table.

The labor and material would, therefore, amount to about 1 cent per lineal foot of covered pipe. Heat for melting dip, inspection and incidentals would probably run this up to 1½ cents per running foot.

1. "Durability of Coal Tar Pitch;" *Eng. News*, 1904, p. 467.

Material.		
25 gallons coal tar pitch at 10 cents per gallon	$2.50	
1,000 yards muslin cloth, 4-inch strips, at 85 cents per 100 square feet	8.50	
		$11.00
Labor.		
1 man	$2 25	
1 helper	2.00	
		4.25
Total		$15.75

In point of cost, simplicity of application and ultimate efficiency, few of the coverings seem to approach the foregoing as a practical coating of value in prolonging the life of underground pipe.

Summary.—After a careful consideration of each and all of the protective materials which were tested for their ability to prevent soil or electrolytic corrosion of iron or steel pipe, the following conclusions have been drawn. It is believed:

1.—That paints as a rule do not prevent electrolysis, but some, no doubt, have a beneficial effect in curtailing soil corrosion.

2.—That the appearance to the naked eye of a paint film is no indication of its permeability to water.

3.—That corrosion of metal may take place beneath a paint film without apparently affecting the appearance of same.

4.—That the metallic body, before being covered, must be smooth and free from rust, moisture, loose scale and foreign matter in order that it be preserved.

5.—That, in general, dips applied hot are better than paints and probably furnish the key to the solution of the prevention of corrosion.

6.—That concrete of itself is not an efficient protection against electrolysis.

7.—That ingredients such as rubber, tallow, lime, etc., usually have a deleterious effect upon the efficiencies of coal tar pitch.

In conclusion, the writer will feel amply repaid for the time and energy expended in testing the various types of so-called preventatives of pipe corrosion, if his results shall prove of any true value to engineers now engaged in the engrossing problem of maintaining underground metallic structures.

Fire Risks of Electric Lighting.

The *Journal of Gas Lighting* introduces the following highly instructive table on this subject by the following mention:

The oft-asserted claims of safety of electric lighting in respect of causation of fire have been again refuted by statistics which are quoted in a recent number of the *Journal für Gasbeleuchtung* by Herr F. Shäfer, of the German Continental Gas Company, of Dessau. The figures that he gives are from an official report of the Statistical Department of the Prussian Ministry of Agriculture, relating to the fires which have occurred in Prussia in the years 1906 and 1907. The damage caused by fires proved to have arisen from different modes of lighting is shown in the appended statement for the 2 years, as well as the total amount of damage, which, in addition to that of which the cause was proved, was in all probability due to the same agents.

Damage Resulting from Fires in Prussia.

Cause of Fire.	Cause Proved.—1906.	Cause Proved.—1907.	Cause Proved or Conjectured—1906.	Cause Proved or Conjectured—1907.
Electrical faults	$47,765	$304,685	$385,060	$757,485
Gas for lighting, cooking or heating	49,090	87,175	115,730	89,401
Petroleum	198,620	182,250	187,780	211,763

These figures are most instructive, as they show that in the year 1907 much more damage through fire was proved to have resulted through electricity than through gas and petroleum together, and this notwithstanding the far wider use of gas than of electricity. The figures also show that the rules for securing the safety of electric lighting promulgated by the Association of German Electricians, of which so much was expected in the way of diminution of damage by fire, have not been instrumental in arresting the continuous increase in the losses caused by fires arising from electrical faults.

Cost of Power Production in a Representative Central Station.

The *Electrical World* for the 2d inst. gives the following as figures just to hand covering the cost of power production in a central station of 4,950 kw. rating for the past year, and showing a reduction of 17 per cent. per kw. hour compared with the preceding 12 months. The plant is a representative steam generating station, with compound condensing engines installed in four units. The service consists of alternating supply at 2,300 volts and direct current power facilities at 500 volts. About 44 per cent. of the company's output is devoted to motor operation, a gain of nearly 4 per cent. in this class of business compared with the previous year. The boiler equipment of the station consists of eight Babcock & Wilcox water-tube outfits rated at 400-horse power each, hand-fired, with natural draft. The engine units are McIntosh & Seymour General Electric machines,

two being of 600 kw., one of 1,500 kw. and the fourth of 2,000 kw. rating, generator ends.

During the year the company generated 6,484,140 kw. hours and sold 5,706,241 units. The power sales came to 2,514,122 kw. hours. The fuel consumption was 9,377 tons of bituminous coal, with an average cost of $3.72 per ton, making the fuel expense per unit generated 0 54 cent. Singularly enough, the total coal consumption was exactly the same last year to a ton, but the cost per ton was then $4.40 at the plant, which brought the total fuel bill for 1908 to $41,546 contrasted with $34,909 in 1909. The unit fuel cost in 1908 was 0.69 cent. The labor cost per kw. hour this year was 0.34 cent against 0.35 cent last year, but in spite of an increase in the energy generated at the station, the total cost with all manufacturing charges included, was $66,050 this year compared with $74,426 in the preceding 12 months. The oil and waste, water, station building, steam plant and electrical equipment repairs came to 0.14 cent per kw. hour generated in 1909. Last year these charges amounted to 0.2 cent. The total labor cost for 1909 was $22,095, compared with $20,920 last year. The chief item of economy was therefore in the fuel cost. The coal consumption per kw. hour delivered at the station switchboard was 3.48 pounds in 1908, while this year it was 3.24 pounds. The total energy delivered at the bus was 7.3 per cent. greater this year than last. The tabulated data follows:

Cost of Manufacture Year Ending June 30, 1909.

Kw. hours delivered at the switchboard	6,484,140
Kw. hours sold	5,706,241
Power sales, kw. hours	2,514,122
Coal burned, tons	9,377
Average coal cost per ton	$3 72
Fuel cost, per kw. hour at 0.54 cent	$34,909.53
Oil and waste	1,300.71
Water	3,730.26
Station wages, per kw. hour at 0.34 cent	22,094.64
Station building repairs	2,402.15
Steam equipment repairs	2,412.85
Electrical equipment repairs	1,199.89
Total	$66,050.03

The distribution cost for the fiscal year 1908-9 was $37,309.91, or 0.66 cent per kw. hour sold. The station labor consisted of four engineers, three oilers, one engine wiper, four switchboard men, six firemen and two coal passers.

The "International Candle" and Other Standards.

A Protest from Dr. Krüss.

Last month Dr. H. Krüss, of Hamburg, raised his voice, per the columns of the *Journal für Gasbeleuchtung*, in opposition to the American-Anglo-French international candle. He primarily objects to the method by which it was reached, which he thought savored too much of the making-ready-to-fit type. The German standard of moisture for the Hefner is 88 volumes of water vapor in 100,000 of air. The English standard for the pentane lamp was, until recently, 100 volumes per 100,000, and on that footing the 10 candle pentane standard was fixed, at the Zurich meeting of the International Photometry Committee, in 1907, and as the result of work done in the English and the German Government laboratories, at 10.95 Hefners; but now the standard of moisture has been changed to 80 volumes per 100,000, and that makes the pentane lamp = 11.11 Hefners. Then, again, the bougie décimale is the twentieth of a Violle unit; Violle declared his unit = 2.08 carcel; the Zurich meeting, 1907, declared the carcel = 10.75 Hefners, therefore, the bougie décimale = 1.12 Hefners—all which presents a chain with weak links. The American Bureau of Standards' unit was based upon a series of electric incandescent lamps, which were found to be equal to 1.14 Hefners each, and it was resolved to let these standards down so as to make them equal to the bougie décimale, 1.12 Hefners. Then it was announced that the new unit = 1 pentane candle = 1 bougie décimale = 1 American candle = 1.11 Hefners = 0.104 carcel.

This is, according to Dr. Krüss, enough to astonish any scientifically thinking man. A physical standard should be unequivocally defined, and capable of reproduction everywhere, under control of exact measurement. There is nothing of the kind here. The new unit is deduced from three different units, each of which rests upon uncertain data, while two of them have had to be varied in order to bring them to the accepted value. Certainly, the pentane lamp is the best of the three standards, but its construction has undergone variations, and its fuel is not of well defined composition, so that there is uncertainty in data based upon the use of this standard.

It is stated that the Hefner is to be largely used as a convenient standard, though not as a unit, and the hope is expressed that by continued careful comparison of the Hefner with the electric incandescent lamps, the new unit may be kept right within 0.1 to 0.2 per cent.

The movement has taken great hold in the three countries, both in gas circles and among the electricians, and Germany has been asked to fall in. But the representatives of all the associations interested had a meeting, along with members of the Charlottenburg Institute, on the 23d April last, and it was unanimously resolved (1) that there was at present no unit which met all requirements; (2) that such a unit is desirable; (3) that such unit must be defined only in one way; (4) that the construction of the standard lamp must be based upon a precise specification, so that it can be reproduced at any time; (5) that among the standards now in question the Hefner best meets the preceding condition; (6) that the proposal does not set up a true international unit, for it is based upon five different materializations of the proposed unit, and that it is unacceptable, as it may be feared that it may lead to inexactness and confusion; (7) that the time is not yet ripe, and that the Government laboratories of the different countries must continue to co-operate for some time yet; (8) that for calculations at present we may reckon 1 pentane candle = 1.11 Hefners, 1 carcel = 10.75 and 1 American candle = 1.11 Hefners; and (9) that, in addition to an international unit, all photometric work should use the metric system—for candle power per 5 cubic feet, liters per carcel, and the like render it difficult, and, in some cases, impossible to make numerical comparisons, even were a common standard of lighting power adopted.

Safety Service Box for Induction Electric Motors.

Mr. H. W. Sykes, of Syracuse, N. Y., writing on this subject in a recent number of *Electrical World*, reports that for some years it was his duty to secure adequate and fool-proof electrical machinery for severe service in coke oven and chemical plants, and the lack of safety appliances on the market has been found very marked, though the alternating current is now so prevalent, with its higher voltages and consequent greater danger to life.

It is no uncommon thing to find 20,000-volt line wires run down a side wall of some small sub-station, from the lightning arresters to the transformers, bare, or very inadequately covered with insulation, and a continual menace to the station attendant or some ignorant helper who may be employed to clean up around the apparatus, or some carpenter making repairs. As to danger from shocks due to grounds, usually, in the case of large industrial systems operating motors in wet and inaccessible places, the circuits are grounded, and, of course, it is only necessary for some careless person to touch accidentally an exposed live contact to receive a shock that may be fatal on even such a low voltage as 440. Skilled electricians are not in so much danger as are the ignorant helpers and laborers; the electrician knows what to expect from an apparently innocent looking wire or terminal, but the non-technical man may accidentally or unconsciously make a contact, particularly if the motor is idle and the machinery driven by it is shut down.

It is right here that I wish to call attention to the universal practice of supplying induction motors of all voltages with the open type of fuse panel, with the terminals and metal ends of the inclosed fuses always alive—a relic of the early days when voltages were low, and now continued on not only 440-volt motors, but also, I am told, on motors of 6,600 volts right in New York and Brooklyn power houses. These exposed fuse panels are a serious menace; the terminals are alive whether the motor is running or not, in the majority of cases, where the starting compensator is used without an extra line switch to cut off the current. Most persons on seeing that a motor is not running are not so careful around the wiring and fuses, thinking, if at all, that the current is off.

I wish to cite one instance of fatal shock resulting from the comparatively low voltage of 440 volts, 60 cycles, directly due to this condition. A machinist took opportunity to work at night when the motor was idle in order to erect a shield over the machine to keep off water, and being tired with his long day's work rested himself by leaning one hand on the slate fuse panel that belonged to the idle motor. He received a fatal shock from the 440-volt current, and his hand gripped the support so hard that his helper could not detach him; there was no way of shutting off current except from the power house, a quarter of a mile away, and by the time that help had arrived, and the man was pulled away from the terminal, he was be-

yond recovery. Now this motor was not running, the starter having cut off the current, but the line, fuse and compensator terminals were fully alive and there were no means at hand to render them quickly and safely dead.

The writer then took up with many of the concerns all over the country the question of securing a safety type of induction motor service box that would prevent such accidents. The ordinary cast iron box with removable fuses would not answer because there was no way of by-passing the starting current of the motor around the fuses to allow the use of proper sizes of fuses to protect under running conditions. No company could furnish such apparatus from anything that it had previously built, and the writer then developed and patented a type of service box for induction motors of all voltages having the following desirable features not previously to be found in apparatus on the market:

1. A service box that would by-pass the starting current of the motor.
2. That would remain closed to the entrance of dirt, foreign matter or moisture, whether the contacts of the same were in the open or closed condition. (All present boxes are wide open when they interrupt the circuit.)
3. That could not be opened or tampered with by any but the authorized attendant, and yet that could be used to open the circuit in case of need by anyone.
4. That, once opened, could not be closed again until the proper attendant had investigated the trouble and taken his precautions.

Some such safety appliance should be required by wiring rules just as much as any fire protective device, as the present fuse panels supplied with motors of all voltages are a constant menace to life of non-technical laborers, helpers and workmen.

Bureau of Information, The American Gas Institute.

Under the direction of the Institute it has been decreed: 1. That the privilege of submitting questions be limited to members of the Institute. 2. Neither the Board of Directors of this Institute, nor the Institute as a body, make themselves in any way responsible for the statements of fact or expressions of view given out by the Bureau of Information.

BUREAU OF INFORMATION, THE AMERICAN GAS INSTITUTE,
HEADQUARTERS, 1943 COMMERCIAL NATIONAL BANK BUILDING.
W. A. BAEHR, Chairman. CHICAGO, ILLS., Aug. 29, 1909.

Question 55, submitted to the Bureau of Information, was as follows:

Question No. 55.—"Please give a list of the best books, or other sources of information, on American practice in gas distribution."

ANSWER BY BUREAU.

There is no satisfactory book on American practice in gas distribution. There is a very good English book, by Mr. Walter Hole, entitled, "Distribution of Gas," published by John Allen & Co., London, 1907, in which there is much reference to American practice. It is in general a very good book of references. The following are suggested as valuable reference papers on this subject:

"High Pressure Gas Distribution," by Mr. J. D. von Maur. Proceedings Am. Gas Institute; Vol. 3..... 1908.
"Notes on Mains and Main Laying," by Mr. Walton Forstall. Proceedings Am. Gas Light Assoc.; Vol. 15..... 1898.
"Consumers' Meters," by Mr. B. H. Spangenberg. Proceedings Am. Gas Light Assoc., Vol. 21..... 1904.
"High Pressure Distribution of To-day," by Mr. H. L. Rice. Proceedings Am. Gas Light Assoc., Vol. 22..... 1905.
"Standards Adopted by American Gas Light Association for Cast Iron Pipe and Specials." Proceedings Am. Gas Light Assoc., Vol. 22..... 1905.
"Long Distance Transmission of Gas," by Mr. W. H. Hammon. Proceedings Ohio Gas Light Assoc..... 1905.
"Instructions for Gas Distribution Employees," by Mr. J. M. Robb. Proceedings Ohio Gas Light Assoc..... 1906.
"The Compression and Transmission of Gas," by Mr. E. A. Rix. Proceedings Pacific Coast Gas Assoc..... 1905.
"Cement Joints," by Mr. J. D. von Maur. Proceedings Western Gas Assoc..... 1905.
"Meter Repair Shop Practice," by Mr. C. L. Day. Proceedings Ills. Gas Assoc..... 1908.
"Report of Board of Revision on Distribution of Gas." Am. Gas Institute..... 1906.
"Description of the Connelly Automatic Governor;" Practical Class Answer. Am. Gas Light Assoc. Proceedings, page 26.. 1898.
"Street Main Records," by Mr. H. E. White. AMERICAN GAS LIGHT JOURNAL, April 9..... 1906.
"High Pressure Distribution," by Mr. R. M. Searle;" "Progressive Age," page 344, July 1..... 1907.
"Pressure Distribution," by Mr. E. A. Rix. This is a continuation of the paper given in the list of Messrs. Rice and Johnson. "Progressive Age," page 700, Nov. 15..... 1906.
"Electrolysis, Report on, for American Gas Light Assoc. Proceedings. American Gas Institute."..... 1906.
"American Practice of Gas Piping," by Mr. Paul Gerhard.
"The Standards Adopted by the Am. Gas Light Association for Cast Iron Pipe and Specials," as given in the American Gas Light Association Proceedings for 1905, have since been modified. Subsequent Proceedings of the Gas Light Association or American Gas Institute will show these modifications.

Question No. 56.—"Do gas companies generally correct the gas made; that is, the gas metered by station meters at manufacturing stations, for drip-water and oil collected from distribution mains throughout the city? Also, is the gas made corrected for barometric pressure as well as temperature, and to what pressures and temperatures?"

ANSWER BY THE BUREAU OF INFORMATION.

Replying to the first section of the question, some companies measure the drip oil collected in the mains, calculate the volume occupied by the hydrocarbon condensate and by the water, as they existed in the gas in the form of vapor, and reduce their "unaccounted for" by this volume. Let us examine into the accuracy of this.

To get purification results, and to conserve the illuminating value of the gas, it is generally recognized that the gas (water gas particularly) should be purified at a temperature of 90° to 95° F. This allows the gas to be station metered at a temperature frequently from 85° to 90°, from which it passes to the holder, where it is further cooled, and thence to the mains, where, for a considerable portion of the year, it reaches its lowest temperature.

From the point of minimum temperature the gas begins to expand and, as it is not in contact with water, it does not follow the formula for expansion set forth in the usual tables, which is for saturated gas. The gas is, therefore, reduced in volume:

(a) By the condensation of hydrocarbon vapors, due to the cooling of the gas from the temperature at the station meter to the temperature at the outlet of the distribution holder.

(b) By the cooling of the water saturated gas from the temperature at the station meter to the temperature at the outlet of the distribution holder. The formula for this reduction is that upon which the usual tables are based.

(c) By the condensation of hydrocarbon vapors, due to the cooling of the gas from the temperature at the outlet of the distribution holder to the minimum temperature reached in the distribution system.

(d) By the cooling of the water saturated gas from the temperature of the outlet of the distribution holder to the minimum temperature reached in the distribution system.

There is an increase in volume:

(e) By the reduction in pressure on the gas between that at the station meter and the consumers' meters.

(f) By the expansion of the gas from the point of minimum temperature in the mains to the average metering temperature in the consumers' meters. This, being generally out of contact with the water, does not expand according to the formula for a saturated gas, but to the formula for a perfect gas.

This statement, of the influences exerted on the volume of the gas from the station meter to the consumers' meter, includes only those that vitally affect the final result. A complete study of all the influences is far more complex and depends largely on local conditions. If the distribution holder has a layer of hydrocarbon condensate floating on the surface of the water in the tank, the interaction between this condensate and the hydrocarbon vapor in the gas can only be known by its influence upon the loss of volume of the gas and the dropping out of hydrocarbon vapors by a thorough knowledge of the constituents of the two. It is possible, but not at all probable, to actually replace, and more than replace, the entire volume of hydrocarbon vapors condensing out of the gas, by the hydrocarbon vapors passing into the gas from the hydrocarbon liquid on top of the water in the tank. Whenever the gas comes into contact with hydrocarbon condensed out at a lower temperature there is a tendency to increase the volume of the gas by the passage of some of this condensate back into vapor.

Again, a study of the influences of temperature and the direction of flow of condensate in the mains, would prove to be somewhat complex. A 20-inch main under asphalt in cities, in the vicinity of this parallel of latitude, has a nearly constant temperature at the bottom, cut a widely varying temperature at top. This results in the winter months in a dephlegmating action of the hydrocarbon vapors. The gas, passing along the cool upper portion of the pipe, is cooled and drops some of its hydrocarbon vapor, which falls or flows down to the bottom, where, the ground temperature being warmer, same is again vaporized and a heavier condensate is left in the mains than obtains in other seasons.

Under these conditions, the propriety of getting a closer approximation to the "unaccounted-for" gas by deducting the volume as vapor of the liquids pumped from the mains is doubtful. The gas, as a rule, suffers changes in volume in the holder far in excess of those changes in the mains, and the companies correcting for condensation

in mains only, taking no cognizance of condensation in holder, are correcting for only one and not the most important class of losses in volume. To actually measure the condensation dropping out in the holder is almost impossible in practice. Frequent readings with hygrometer at holder inlet and outlet would give bases on which reliable calculations could be made.

So far, nothing has been said about complications introduced where a correction is made to reduce the observed volume at the station meter to the volume of 60° by the use of the factors set forth in the usual tables. By these factors the reduction due to the condensation of aqueous vapor down to 60° is accounted for. If then, the gas enters the mains at temperatures above 60°, the water condensing out between the inlet to mains' temperature and 60° will have been accounted for twice—once for formula and once by measurement of water in mains. To illustrate the difference in estimating "unaccounted-for" gas, let us suppose 1,000 cubic feet of water gas is registered on a station meter at a temperature of 90° F., and 10 inches back pressure from holder and rate of flow; that the gas is made from an asphalt base; that it enters the mains at 70° F.; is cooled therein to 40°, and passes through the consumer's meters at 55° F. and 1½ inches pressure, and that it registers 870 cubic feet on the consumers' meters. What is the "unaccounted-for" gas, figuring:

1. Correcting the gas to 60° and deducting from the "unaccounted-for" gas only that portion collected as liquid from the drips.
2. Applying all the corrections set forth in this answer.

First Solution:

1,000 cubic feet of gas at 90° = 917 cubic feet at 60°
Consumers' registers..... 870 " "

47 " "

Gallons of liquid collected from drips:

Oil = .12 gallon = .9 pound = 3.6 cubic feet.
Water = .8 pound = 16.8 " "

20.4 " "

and, taking the difference (47 — 20.4), we obtain for "Unaccounted-for" gas..... 26.6 cubic feet.

Second Solution:

At 90° station meter..... 1,000 cubic feet.
Consumers' registers..... 970 " "

Difference ..... 130 cubic feet.

	Decrease. Cu. Ft.	Increase. Cu. Ft.	
a. Loss in hydrocarbon vapor cooling in holder from 90° to 70°—103 gallons.....	3.09		
b. Reduction in volume of saturated gas cooling from 90° to 70°—(10 inches pressure).. ...	588.51		
c. Loss of hydrocurbon vapor cooling in holder 70° to 40°...	3.60		
d. Increase in volume due to change from 10 inches pressure in holder to 1½ inches in mains, 934.80 increased to 954.43 cubic feet.		19.63	
e. Reduction of 954.43 cubic feet, from 70° to 40°, reduced to 885.34 cubic feet	69.00		
f. Expansion to 35° as unsaturated gas to 910.53, an increase of.....		25.19	
	134.20	44.82	130.00
	44.82		98.38
	89.38		40.62

In first solution, not based on accuracy, the unaccounted-for gas is $\frac{26.6}{917}$ = 2.9 per cent. of station meter registration corrected to 60°.

In second solution, the unaccounted-for gas is $\frac{40.62}{1{,}000}$ = 4.06 per cent. of meter registration.

If the gas in the first problem had been corrected to 55° the temperature of the consumers' meters assumed in the example:

1,000 cubic feet at 90°.... 905 cubic feet at 55°.
Consumers' registers.... 870 " "

Difference..... 35
Accounted for in drips.. 20.4

14.6 cubic feet or $\frac{14.6}{905}$ = 1.6 per cent.

If the average temperature of the gas at the consumers' meter each month could be ascertained, and the gas at the station meter could be orrected to this average temperature, instead of to 60°, the unaccounted-for gas would be as close an approximation to what actually occurs as could be had without resort to very careful correction, involving many, and in actual work, very difficult observations. From what has been shown the hopelessness of getting in practice exact figures on leakage is obvious. Nor can one company's figures be compared against another where the bald statement of such and such per cent. of leakage is made. The method of computing the leakage must be set forth.

Gas companies usually do not correct for barometric pressure in figuring on unaccounted-for gas, since the average barometer from year to year does not change sufficiently to affect results; but in the larger companies other necessary daily observations and calculations, such as comparisons of make one day against another, make it essential to correct for barometer.

The above answer applies to the ordinary low pressure district, and applies more or less to high pressure distribution, where the gas is enriched with oils beyond the compression station or stored in outlying holders after compression. Even then it is doubtful if it is advisable to apply much correction as outlined in this answer.

Items of Interest
FROM VARIOUS LOCALITIES.

On the 1st prox., Mr. E. H. Mathews will vacate the position of General Manager to the Morristown (N. J.) Gas Light Company, to fill a responsible place on the engineering staff of the Brooklyn Union Gas Company, with headquarters in the Nassau branch of that Company, at Kent avenue and Cross street, Brooklyn, N. Y. The duties of General Manager at Morristown will be taken over by Mr. F. S. Breese.

"W. G.," writing from Rockford, Ills., some days ago, remarks: "I'm sorry and I'm pleased, at the same time, to inform you that Mr. F. S. Mariner, who has been for quite a while Superintendent of the construction force of the Rockford Gas Light and Coke Company, has resigned that position to join the sales division of the well-known real estate firm of Eastwood & Stockberger, of this city. So I'm sorry he leaves the Gas Company, and am pleased over the fact that in his new field he will have excellent opportunity to get together rapidly a good bank account."

The Geist syndicate will take possession of their new acquirement at Atlantic City, N. J., the first prox. The management of the property will be taken on by Mr. Carleton Geist.

"A DISSOLVING SUPPER," so writes "O. A. G.," was tendered the employees by the Chelsea (Mass.) Gas Light Company the evening prior to the day when the electric division of the Company was to be divorced from the gas division. Of course, both gas and electric divisions were represented at the feast, which in no sense partook of the funereal, unless a carper might declare that some of Assistant General Manager Riley's sentences were a trifle doleful. Particularly when he admonished the men to be faithful to the end. Other admonishers were General Foreman, W. H. Pettengill, Chief Operator, A. E. Mace and Superintendent T. E. Beedy. Respecting the latter, it may be said that no criticism was intended for the others when the boys generally agreed that 'Beedy was the best of the bunch.' The Edison folks, however, may surely count on the best services of the men, whose recollection of the treatment afforded them by the Chelsea Gas Light Company is all to the good."

The new holder for the Atlanta (Ga.) Gas Light Company will be constructed by the Messrs. Bartlett-Hayward Co., of Baltimore, Md. The vessel which will store approximately 2,000,000 cubic feet, is to be of the 4-lift order, in steel tank, 144 feet diameter by 36½ feet in depth. The weight of the structure will be about 1,300 tons. The local engineer in charge of construction is, of course, Mr. S. Norcross.

The "remains" of the old City Gas Company, of Beatrice, Neb., were disposed of by Mr. H. V. Riesen, receiver at auction the afternoon of the 1st inst. The purchaser was Mr. John F. Stout, an attorney who represented the former bondholders, at his bid of $600.

The Committee on Light, Richmond (Va.) City Council, held a decidedly heated session the night of the first inst. The subject under consideration was the bids submitted for a supply of gas coal during the ensuing year. Several bids were put in, but these were all rejected. It was finally decided to readvertise for bids, the specifications to be so worded as to call for a test of the coal under ordinary working conditions before an award would be made. Meanwhile, an arrangement was made with the lowest bidder (Chesapeake and Ohio

Coal Agency) under which it will furnish the coal necessary to keep the plant going until the new bids shall have made it possible to make a yearly contract.

Mr. Henry R. Burgess, of Elmira, N. Y., has been appointed travelling salesman for the Rector Gas Lamp Company, with headquarters in New York. He is sure to make a go of it.

The new building, of brick and stone, to be erected for office purposes at the intersection of Hemenway and Gainsboro streets, by the Charlestown (Mass.) Gas and Electric Company, will be constructed by the Whiton & Haynes Company.

The Gas Economizer Mfg. Co. has been incorporated at Newport News, Va., by Messrs. W. G. Munyon, C. Bargamin and J. W. Munyon. The last named is Secretary of the Company, which is capitalized in $50,000.

Messrs. Drexel & Co. and the Brown Brothers have jointly purchased from Mr. C. H. Geist and the C. H. Geist Company the $20,000,000 first and refunding sinking fund mortgage, issued upon the properties of the Wilmington (Del.) Gas Light Company. The bonds are first 5's and are to run for 40 years from the 1st inst.

"P. R. S.," writing from Topeka, Kas., under date of the 2d inst., forwards the following: "The United Gas Company and the Edison Electric Light Company, of Wichita, were sold to the Electric Bond and Share Company, of New York, yesterday, the consideration being about $2,000,000. All of the original owners of the Wichita concern retire except J. O. Davidson, C. H. Smith and T. G. Fitch, who will serve as Directors of the New York Company. The men connected with the New York Company, who have been here completing the deal, are Judge McCune, of Kansas City, General Western Counsel, New York Company; Neil Weathers, New York; H. B. Wright, of the Wright Investment Company, of Kansas City; C. M. Maxwell, Vice-President of the American Gas and Electric Company. The new President of the Company will be F. G. Sykes, of New York. J. O. Davidson and his associates still own the Companies in Hutchinson and Newton. They are the ones who piped the gas from the fields in southeastern Kansas to the cities and towns in southwest Kansas."

Last week we had occasion to mention the resignation of Superintendent Z. M. Jenks from the services of the Woonsocket (R. I.) Gas Company, and to that mention we desire to add the following, as showing the affectionate regard in which he was held by his men, and for which mention we are indebted to the attention of Mr. T. G. Evans: "The employees and associates of Mr. Zeuner M. Jenks, who recently resigned as Superintendent of the Woonsocket Gas Company, wishing to leave with him a constant reminder of long and pleasant associations, and a token of their esteem and friendship as well, delegated Foreman Charles A. Smith to present Mr. Jenks with a handsome smoking set. Mr. Smith called on Mr. Jenks, at his home in Union Village, the night of the first inst., and, after explaining the object of his visit, presented the set. It consists of an ash tray, cigar receiver, match box, meerschaum pipe and a cigar holder. The tray bears the inscription, 'Z. M. Jenks: From His Employees and Associates: Sept. 1, 1909.' The recipient was taken completely by surprise, and for a time failed to find words to express his deep appreciation of the gift and the kindly sentiment it represented. However, Mr. Jenks finally uttered an expression that evidently came right from his heart, to the effect that he would always hold in affectionate remembrance the men who worked with and under him for the best interests of the Woonsocket Gas Company."

It is asserted that a trial, now going on at St. Johns, Fla., opposite Jacksonville, has successfully demonstrated the fact that gas engines can be successfully operated on producer gas resulting from the carbonization of peat. The trial is being conducted by the Gibbs Gas Engine Company, and the results so far obtained have been unequivocally on the side of certainty with economy.

The latest booklet from "the press" of the Chicago Peoples Gas Light and Coke Company is a handsome specimen of the printers' art. Its title is that of "Home Sunlight," and it certainly does fittingly illustrate and describe modern gas fixtures and mantle lights for use in the home.

The proprietors of the Jackson (Mich.) Gas Company have filed a certificate with the proper branch of the State government announcing an increase of $350,000 in the Company's capital stock, which now amounts to $600,000.

The Tempe Normal School, Phœnix, Ariz., is being equipped with a gas plant, the capacity of which will be fully equal to the requirements of the students in their experimental work, and to the furnishing of fuel to the kitchens as well.

"R. R. S." forwards the following under date of the 4th inst.: "Mr. George T. Eldridge, who has served the Harrisburg (Pa.) Gas Company with efficiency for a long time, has been appointed Commercial Agent of the Company, vice Mr. J. Diffenderfer, resigned. Mr. William H. German succeeds Mr. Diffenderfer as Chief Clerk, and Mr. W. H. Kautz succeeds to the cashiership. Mr. C. Earl Peters takes the place formerly filled by Mr. Kautz."

The electric light company at Yokkaidie, Japan, has installed a 750-kw., Westinghouse turbo-alternator in its Hiye Ken plant, near Magoya. The turbine is to be operated at 200 pounds steam pressure, exhausting into a vacuum of 27 inches. Three-phase, 60-cycle current, at 2,200 volts, for lighting and power purposes, will be supplied by the new generator, supplanting the old reciprocating engine-driven equipment, which is to be removed. Three 55-horse power Westinghouse gas engines have been installed by the Fievewaka Coke Works, of Tokio, to operate its coal washing plant. These engines will take as fuel the sulphur gas derived from the coke ovens, having an average calorific value of 400 B.T.U. per cubic foot. This new equipment is additional to a set of 11 by 12-inch, double-cylinder Westinghouse gas engines, driving a Westinghouse, 125-volt, direct-current generator.

Mr. B. R. Clark has been appointed Superintendent of the Woonsocket (R. I.) Gas Company, vice Mr. Zeuner M. Jenks, resigned. Mr. Clark has acted in the capacity of assistant to Mr. Jenks for some months. Mr. Clark was formerly in the service of the Whatcom County Railway and Light Company, having charge of the gas division of its property in Bellingham, Wash.

The United Gas Improvement Company has arranged to construct a 4-story building on the property owned by it at the northeast corner of 11th and Market streets, Philadelphia. The structure is to be of concrete and brick, and will cost not far from $100,000.

The Public Service Gas Company, with headquarters in Newark, N. J., will hereafter be operated as a gas company pure and simple, and not as a conjoint factor in the street railway and electric enterprises owned by the Public Service Corporation of New Jersey. By-the-way, if one can believe the tales told by men who have visited this office with a view to obtaining employment, and who have been on the payrolls of the Public Service Corporation, the rate of wages obtaining in and by its rank-and-file is of a very low scale.

Mr. Walter A. Leuenberger, Superintendent of the manufacturing, distributing and constructing divisions of the Racine (Wis.) Gas Company, has resigned in order to accept the position of Superintendent of the gas plant at Tacoma, Wash. The resignation becomes effective the 25th inst., and he will take up his new duties the 10th prox. That makes the third man in high service in the Racine Company since Mr. Jno. I. Beggs commenced to assert his authority.

The Massachusetts Board of Gas and Electric Light Commissioners has issued an order authorizing the Fitchburg Gas and Electric Light Company to increase its capital by emitting 675 additional shares of stock at $85 per share, the par being $50. The money obtained is to be devoted to taking up certain note indebtedness incurred while the work of extending and bettering the plants was underway.

At the annual meeting of the Chelsea (Mass.) Gas Light Company no change was made in the executive management.

The residents of Chatham, N. J., at last have gas, the finishing touches to the connecting up system having been made the last week in August. The Hillside section was the first to enjoy the benefit of this long-delayed blessing. Yes; blessing.

On the occasion of the going away of Robert Johnson, who left the service of the Weston (Mass.) Gas Light Company to engage with the Randolph (Mass.) Electric Company, the men presented him with a meerschaum pipe and a cigar holder, with the injunction that he "keep smoking."

The properties of the Eufaula (Ala.) Gas, Electric Light and Power Company have been sold by Mr. U. F. Maury to Mr. J. M. Hill, of Philadelphia. This sale was brought about through the efforts of the M. J. Loxley Company, of Philadelphia, and Mr. Loxley is now interested as a part owner of the property.

The Market for Gas Securities.

The death of Mr. E. H. Harriman, which untoward event had been liberally discounted ever since his momentous journey to Europe of some months ago, had, as was expected, a decidedly adverse effect upon the market. However, the liquidation was not nearly as severe as many believed or as others hoped it would be. While the deceased financier never had a large direct interest with the gas industry, the writer, who has had quite some fair knowledge of the sort of man Mr. Harriman really was, is glad of the opportunity to say here that no other of the world's great financiers was closer to the people than he was. His home life was likely as beautiful as that of any other man who ever lived. In every sense it was typical of that which was democratic, truthful, earnest and affectionate. And in the ending what more beautiful tribute may be paid to any man than to say of him, "He was loved by his own in his home."

The general tendency of the market is towards strength, and this particularly applies to Brooklyn Union, Peoples, of Chicago, and Washington, D. C.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

SEPTEMBER 13.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies,	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated Gas Co.	$78,177,000	100	145	145¼
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	98	101
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	—	105
Mutual Gas Co.	3,500,000	100	155	165
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	100	101½
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	—	100	101
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	104	107
Con. 5's, due 1945, J. & J.	1,500,000	—	97	101
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	94	100
Standard	5,000,000	100	—	75
Preferred	5,000,000	100	70	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	100	105
The Brooklyn Union	15,000,000	1,000	148	150
1st Con. 5's, due 1948, M. & N.	15,000,000	—	91½	92
Yonkers	299,650	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	1⅛	1¼
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	65
" 1st Mtg. 5's	500,000	1,000	90	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	73	73½
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,660,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	29,500,000	100	92	93
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	90½	91
Preferred	3,026,500	100	75¼	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	—	105
Mortgages, 6's	3,600,000	—	—	118
Chesapeake, 1st 6's	1,000,000	—	—	—
Equitable, 1st 6's	910,000	—	—	—
Consolidated, 1st 5's	1,490,000	—	—	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	—	—	100
Denver Gas and Electric	458,000	—	102	105
Detroit City Gas Co	5,000,000	50	—	50
" Prior Lien 5's	4,619,000	1,000	97	100½
Detroit Gas Co., 5's	381,000	1,000	75	80
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	102
Essex and Hudson Gas Co.	6,500,000	—	39	40
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	112	113½
" Bonds, 5's	10,500,000	—	103	103½
Indianapolis	2,000,000	—	60	70
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	200,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede Gas Co., St. Louis	10,000,000	100	104	105
Preferred	2,500,000	100	—	98
Bonds	10,000,000	1,000	104	—
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,370,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	60	60½
Massachusetts Gas Companies, of Boston	25,000,000	100	65	—
Preferred	25,000,000	100	92	—
Montreal Gas Co., Canada	2,000,000	100	218	218¾
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	56	58
Bonds, 6's	6,000,000	—	137	138
New Haven Gas Co.	2,000,000	25	200	—
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	114	114¼
1st Mortgage	20,100,000	1,000	—	—
2d "	2,500,000	1,000	104	—

Advertisers' Index.

New advertising, or changes in standing ads., to assure attention the issue following their reception, must be in hand on Wednesday.

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D. McDonald & Co., Albany, N. Y. 709
Helme & McIlhenny, Philadelphia, Pa. 711
John J. Griffin & Co., Philadelphia, Pa. 664
Keystone Meter Co., Royersford, Pa. 710
Maryland Meter and Mfg. Co., Baltimore, Md. 710
Metric Metal Co., Erie, Pa. 711
Nathaniel Tufts Meter Co., Boston, Mass. 710
New York Improved Meter Co., New York City. 710
Pittsburg Meter Co., East Pittsburg, Pa. 690
Rotary Meter Co., New York City. 683
Sprague Meter Co., Bridgeport, Conn. 709

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia. 711
D. McDonald & Co., Albany, N. Y. 709
Helme & McIlhenny, Philadelphia, Pa. 711
John J. Griffin & Co., Philadelphia, Pa. 664
Keystone Meter Co., Royersford, Pa. 710
Nathaniel Tufts Meter Co., Boston, Mass. 710
New York Improved Meter Co. New York City. 710
Pittsburg Meter Co., East Pittsburg, Pa. 690
Sprague Meter Co., Bridgeport, Conn. 709

PREPAYMENT METER ATTACHMENTS.

New York Improved Meter Co., New York City. 710

WATER METERS.

Pittsburg Meter Co., East Pittsburg, Pa. 690

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass. 704
Donaldson Iron Co., Emaus, Pa. 696
Economical Gas Apparatus Construc. Co., Toronto, Ont. 682
R. D. Wood & Co., Philadelphia, Pa. 706

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 692
Perkins Co., New York City. 692
Westmoreland Gas Coal Co., Philadelphia, Pa. 703

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., New York City. 706

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y. 703

GAS TAPPING MACHINES.

George Light, Dayton, O. 703
H. Mueller Manufacturing Co., Decatur, Ills. 686

CANNEL COALS.

Perkins & Co., New York City. 702

STOKING MACHINERY.

G. A. Bronder, New York City. 701
Laclede-Christy Clay Products Co., St. Louis, Mo. 700
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 689

CONVEYORS—ALL KINDS.

Bartlett-Hayward Co., Baltimore, Md. 705
Cruse-Kemper Co., Philadelphia, Pa. 692
C. W. Hunt Company, New York City. 704
Economical Gas Apparatus Construc. Co., Toronto, Ont. 682
G. A. Bronder, New York City. 691
Kerr Murray Mfg. Co., Fort Wayne, Ind. 705
The Gas Machinery Co., Cleveland, O. 684
The Stacey Mfg. Co., Cincinnati, O. 707
Western Gas Construction Co., Fort Wayne, Ind. 712

CHARGING BARROWS & COAL WAGONS.

Davis & Farnum Mfg. Co., Waltham, Mass. 704
Kerr Murray Mfg. Co., Fort Wayne, Ind. 705
The Stacey Mfg. Co., Cincinnati, O. 707

GAS ENRICHERS.

Standard Oil Co., New York City. 703

COKE CRUSHERS.

Bartlett-Hayward Co., Baltimore, Md. 705
C. M. Keller, Columbus, Ind. 703

GAS METER CONNECTIONS.

H. Mueller Manufacturing Co., Decatur, Ills. 687

GAS COCKS.

H. Mueller Manufacturing Co., Decatur, Ills. 687

GAS GAUGES.

The Bristol Co., Waterbury, Conn. 696

GAS GOVERNORS.

Chaplin-Fulton Mfg. Co., Pittsburg, Pa. 702
Connelly Iron Sponge & Governor Co., New York City. 701
Evens & Howard Firebrick Co., St. Louis, Mo. 694
Isbell-Porter Co., Newark, N. J. 692
Pittsburg Meter Co., East Pittsburg, Pa. 690
Reynolds Gas Regulator Co., Anderson, Ind. 701

CEMENTS.

C. L. Gerould, New Castle, Pa. 700
Laclede-Christy Clay Products Co., St. Louis, Mo. 700
Strassburger Bros., Chicago, Ills. 700

RETORTS AND FIREBRICKS.

Baltimore Retort and Firebrick Co., Baltimore, Md. 700
Chamber Oven Co., Milwaukee, Wis. 687
Didier-March Co., New York City. 685
Evens & Howard Firebrick Co., St. Louis, Mo. 694
Gas Bench Construction Co., St. Louis, Mo. 693
Henry Maurer & Son, New York City. 693
Improved Equipment Company, New York City. 686
James Gardner, Jr., Co., Bolivar, Pa. 702
J. H. Gautier & Co., Jersey City, N. J. 700
Laclede-Christy Clay Products Co., St. Louis, Mo. 700
Missouri Firebrick Co., St. Louis, Mo. 700
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 689

INCLINED RETORTS.

Baltimore Retort and Firebrick Co., Baltimore, Md. 700
Didier-March Co., New York City. 685
Evens & Howard Firebrick Co., St. Louis, Mo. 694
Gas Bench Construction Co., St. Louis, Mo. 693
Improved Equipment Company, New York City. 686
Laclede-Christy Clay Products Co., St. Louis, Mo. 700
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 689

VERTICAL S'S.

Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 701
Didier-March Co., New York City. 685
Evens & Howard Firebrick Co., St. Louis, Mo. 694
Gas Bench Construction Co., St. Louis, Mo. 693
Improved Equipment Company, New York City. 686
Laclede-Christy Clay Products Co., St. Louis, Mo. 700
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 689

REGENERATIVE FURNACES.

Baltimore Retort and Firebrick Co., Baltimore, Md. 700
Bartlett, Hayward & Co., Baltimore, Md. 705
Didier-March Co., New York City. 685
Evens & Howard Firebrick Co., St. Louis, Mo. 694
Gas Bench Construction Co., St. Louis, Mo. 693
Improved Equipment Company, New York City. 686
J. H. Gautier & Co., Jersey City, N. J. 700
Laclede-Christy Clay Products Co., St. Louis, Mo. 700
Missouri Firebrick Co., St. Louis, Mo. 690
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 689

SELF-SEALING MOUTHPIECE DOORS.

Bartlett-Hayward Co., Baltimore, Md. 705
Continental Iron Works, Brooklyn, N. Y. 706
Davis & Farnum Mfg. Co., Waltham, Mass. 704
Isbell-Porter Co., Newark, N. J. 692
Improved Equipment Company, New York City. 686
Kerr Murray Mfg. Co., Fort Wayne, Ind. 705
Parker-Russell Mining and Mfg. Co., St. Louis, Mo. 689
Quintard Iron Works, New York City. 693
R. D. Wood & Co., Philadelphia, Pa. 706
The Gas Machinery Co., Cleveland, O. 684
The Stacey Mfg. Co., Cincinnati, O. 707
Western Gas Construction Co., Fort Wayne, Ind. 712

INCANDESCENT GAS LAMPS.

General Gas Light Co., Kalamazoo, Mich. 689
Welsbach Company, Gloucester, N. J. 698

BURNERS.

Wm. M. Crane Co., New York City. 696

STREET LAMPS.

Thos. T. W. Miner, New York City. 682
Welsbach Street Lighting Co., New York and Phila. 698

GAS BLAST FURNACES.

American Gas Furnace Co., New York City. 694

PURIFIERS.

Bartlett-Hayward & Co., Baltimore, Md. 705
Connelly Iron Sponge & Governor Co., New York City. 701
Cruse-Kemper Co., Philadelphia, Pa. 692
Davis & Farnum Mfg. Co., Waltham, Mass. 704
Evens & Howard Firebrick Co., St. Louis, Mo. 694
Isbell-Porter Co., Newark, N. J. 692
Kerr Murray Mfg. Co., Fort Wayne, Ind. 705
Quintard Iron Works, New York City. 693
R. D. Wood & Co., Philadelphia, Pa. 706
The Stacey Mfg. Co., Cincinnati, O. 707
The United Gas Improvement Co., Philadelphia, Pa. 699
Western Gas Construction Co., Fort Wayne, Ind. 712

VALVES.

Bartlett-Hayward & Co., Baltimore, Md. 705
Continental Iron Works, Brookln, N. Y. 702
Davis & Farnum Mfg. Co., Waltham, Mass. 704
Economical Gas Apparatus Construc. Co., Toronto, Ont. 682
Isbell-Porter Co., Newark, N. J. 692
Kerr Murray Mfg. Co., Fort Wayne, Ind. 705
Ludlow Valve Manufacturing Co., Troy, N. Y. 693
R. D. Wood & Co., Philadelphia, Pa. 706
The Gas Machinery Co., Cleveland, O. 684
The P. H. & F. M. Roots Co., Connersville, Ind. 695
The Stacey Mfg. Co., Cincinnati, O. 707
Western Gas Construction Co., Fort Wayne, Ind. 712

(Continued on page 6-2.)

DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO.,
N. W. CORNER BROAD AND ARCH STS.,
PHILADELPHIA, PA., Sept. 8, 1909.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable Oct. 15th, 1909, to stockholders of record at the close of business, Sept. 30, 1909. Checks will be mailed.

1788-5 LEWIS LILLIE, Treasurer.

Position Wanted
As Superintendent,

By a competent gas man who has had practical experience in all branches of the business, both coal and water gas. At present employed. A-1 references.

1755-tf Address, "R. C.," care this Journal.

Position Wanted.

Young married man, engineering graduate and now employed as general superintendent of several gas properties, desires to make a change to position as department superintendent manufacturing or distribution of larger company. Can show results in either.

Address, "CLAY,"
1787-2 Care this Journal.

WANTED,
A Position as Manager or Superintendent

Of a coal or water gas plant, or combined plant. Am getting the best of results at present place of employment. Have excellent recommendations. Address, "F. J. R.,"

1787-4 Care this Journal.

Position Wanted
As New Business Manager of a Gas Company.

Seven years' experience. Can show results. At present employed. First-class references.

1787-2 Address, "S.," care this Journal.

Position Wanted.

An all-round gas man, married, 5 years' experience with one company, wants position as gasfitter or gas maker with small company. O.K. references. Address,

1788-1 CHAS. KARLICK, P.O. Box 171, Algonquin, Ills.

WANTED.
Accountant-Manager Desires a Position

With a gas company in State of New York. Thoroughly familiar with all requirements of public service commissions, taxes, tests, reports, etc.

Address, "M. D.,"
1788-1 Care this Journal.

WANTED,
Position as Chief Clerk of Gas, Electric, or Combined Gas and Electric Property.

Eight years' experience. Address,

1788-1 "QUERY," care this Journal.

WANTED,
Position as Superintendent of Water or Coal Gas Plant, or Both.

Medium size town preferred.
Address, "GAS SUPERINTENDENT,"
1784-2 Care this Journal.

WANTED,

By a corporation, within the next 30 days, a competent and practical engineer, one who has knowledge of drafting and engineering, to take charge of several combination gas and electric light and water works. Permanent position. State salary wanted and give full references, which will be treated confidentially. Address, "H. C. S., JR.,"

1788-2 Care this Journal.

WANTED,

Second-hand water gas set complete, of 250 cu. ft. capacity per day. Also 4 second-hand purifying boxes of like capacity, with complete connections, carriage, etc.

Address, "F. P. M.," Room 516, 84 State Street,
1786-3 Boston, Mass.

FOR SALE,

One 5-foot Lowe water gas set, including elevator, engine and blower; 2 coal gas benches of 6's, including hydraulic mains, scrubber and condenser; 2 exhausters; Connelly governor; 2 6-foot McDonald station meters; 4 12 feet x 14 feet purifying boxes, with center seal, and gasholder in steel tank, capacity over 100,000 cubic feet. Operated but 3 years and in good condition.

1787-2 Address, "G.," care this Journal.

FOR SALE,

One set of 4 purifying boxes 12 feet 8 inches by 10 feet 9 inches by 3 feet, in good condition, with centerseal and 10-inch connections. Also one American 8-foot station meter.

1771-tf YORK GAS CO., York Pa.

FOR SALE,
Two (2) No. 3 Rotary Station Meters.

Capacity, 500 to 5,000 cubic feet per hour. Meters have never been in use, owing to change in works. Will dispose of at a bargain.

KELSEY, BREWER & CO.,
1788-3 Grand Rapids, Mich.

FOR SALE.

One Primary Air Condenser, 20 feet high, 4 feet 6 inches diameter, 12-inch connections.
One Secondary Air or Water Condenser, 20 feet high, 4 feet diameter, 10-inch connections.
One Secondary Water Condenser, 15 feet high, 3 feet, 6 inches diameter, 10-inch connections.
Two Scrubbers, each 4 feet diameter, 10-inch connections.
One Scrubber, 3 feet diameter, 12-inch connections.
One 8-inch Roots Exhauster, with 3 by 4½ Upright Engine, direct connected.
Four 10 by 10 by 3-Foot Lime Purifying Boxes, with 12-inch connections.
One Smith-Vaile No. 2 Pump.
One Davidson 4¼ by 2½ by 6-Inch Pump.
One American Meter Company Station Meter, 5 feet 6 inches by 5 feet 6 inches.
One American Meter Company Station Meter, 3 feet 6 inches by 3 feet 3 inches.
One Cast Iron Hydraulic Main, 10 feet long.
One Wrought Iron Hydraulic Main, 12 feet long.
One Wrought Iron Hydraulic Main, 21 feet 6 inches long.
Ironwork for 4 benches of 6's.
One 12-Inch Connolly Street Main Pressure Governor, with by-pass valves.
One No. 10 P. & A. Tar Extractor.
One 3-Foot U. G. I. Water Gas Set, complete.
3,500 Bushels of Oxide.

All of the above in close proximity to Kansas City and in first-class condition. Address, "NATURAL GAS."

1787-4 Care this Journal.

(Concluded from page 681.)

PURIFYING MATERIALS.

Connelly Iron Sponge & Governor Co., New York City 701
F. Behrend, New York City 682
The United Gas Improvement Co., Philadelphia, Pa... 699

EXHAUSTERS.

Connelly Iron Sponge & Governor Co.,New York City 701
Connersville Blower Company, Connersville, Ind..... 708
Davis & Farnum Mfg. Co., Waltham, Mass..... 704
Isbell-Porter Company, Newark, N. J..... 692
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 705
Piqua Blower Co., Piqua, O..... 693
The P. H. & F. M. Roots Co., Connersville, Ind..... 695

HIGH PRESSURE GAS GOODS.

H. Mueller Manufacturing Co., Decatur, Ills..... 687

PURIFIER AND SCRUBBER TRAYS.

Bartlett-Hayward Co., Baltimore, Md..... 705
Cabot Mfg. Co., Hoboken, N. J..... 703
Western Gas Construction Co., Fort Wayne, Ind..... 712

PIPE LINE TOOLS.

H. Mueller Manufacturing Co., Decatur, Ills..... 687

GAS PLANT TOOLS.

H. Mueller Manufacturing Co., Decatur, Ills..... 687

GAS STOVES.

American Meter Co., New York and Philadelphia..... 697
Keystone Meter Co., Royersford, Pa..... 710
Maryland Meter & Manufacturing Co., Baltimore, Md... 710
Nathaniel Tufts Meter Co., Boston, Mass..... 710

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich..... 682

GASHOLDERS.

Bartlett-Hayward Co., Baltimore, Md..... 705
Continental Iron Works, Brooklyn, N. Y..... 702
Cruse-Kemper Co., Philadelphia, Pa..... 692
Davis & Farnum Mfg. Co., Waltham, Mass..... 704
Deily & Fowler Mfg. Co., Philadelphia, Pa..... 708
Economical Gas Apparatus Construc. Co., Toronto, Ont. 682
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 705
R. D. Wood & Co., Philadelphia, Pa..... 706
Riter-Conley Mfg. Co., Pittsburgh, Pa..... 691
The Stacey Mfg. Co., Cincinnati, O..... 707
Western Gas Construction Co., Fort Wayne, Ind..... 712

STORAGE TANKS.

Bartlett-Hayward Co., Baltimore, Md..... 705
Davis & Farnum Mfg. Co., Waltham, Mass..... 704
Quintard Iron Works, New York City..... 693
The Stacey Mfg. Co., Cincinnati, O..... 707
Western Gas Construction Co., Fort Wayne, Ind..... 712

LEATHER BELTING.

Chas. A. Schieren Co., New York City..... 688

PATENTS, TRADE-MARKS AND COPYRIGHTS.

Royal E. Burnham, Washington, D. C..... 703

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

IMPROVED AMMONIA CONCENTRATOR.

About 100 in use. Write to

STROH & OSIUS, Patentees, or

MICHIGAN AMMONIA WORKS, - Detroit, Mich.

WILLIAM A. BAEHR,

CONSULTING ENGINEER,

Commercial National Bank Building,

CHICAGO.

Also Representing

The Bartlett-Hayward Company.

Celebrated Lux Gas Purifying Mass

Will Save 50 Per Cent. Labor.

Used in the Gas Works of Berlin, Kiel, Frankfort, Vienna, Amsterdam, Antwerp, London, Edinburgh, Copenhagen, Madrid, Seville, Barcelona, Rio de Janeiro and others. :: :: ::

Sole Importer, F. BEHREND,

54 Front St., New York.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS, SPECIFICATIONS AND ESTIMATES PREPARED.

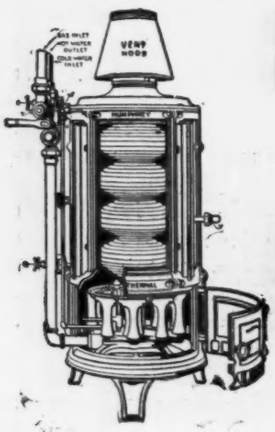
AMERICAN OFFICE:

269 Front St., East, Toronto, Canada.

LLOYD CONSTRUCTION COMPANY

GAS APPARATUS.

DETROIT—MICHIGAN



Humphrey Auto-Thermal Instantaneous Water Heaters

Have every known desirable feature helping to efficiency, economy, durability and absolute safety.

FULLY GUARANTEED.
PRICES LOW.
QUALITY AND SERVICE HIGH.

Will you help us sell them?

HUMPHREY CO.,

Kalamazoo, Mich., U. S. A.

"THE MINER"

GLOBE STREET LAMPS.

OVER FORTY YEARS IN USE THE WORLD OVER.

THE BEST STREET LAMPS for ALL KINDS OF GAS OR BURNERS.

This is only one of a Large Variety of Styles.

SEND FOR CATALOGUE.

THOS. T. W. MINER,

821 and 823 Eagle Avenue, New York.

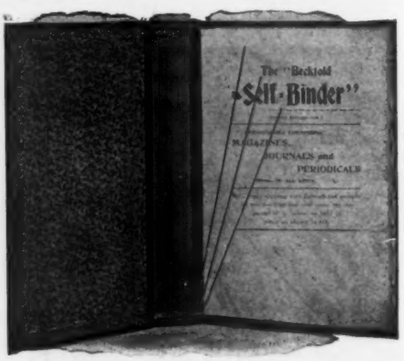
NO. 100 LAMP.

BINDERS FOR THE JOURNAL.

PRICE, $1.

FOR SALE BY

AMERICAN GAS LIGHT JOURNAL 42 Pine St., New York City.



Interior view of Rotary Meter House, North Shore Gas Co., Waukegan, Ill.
First Rotary Meter installed January, 1907, 60,000 cu. ft. capacity per hour.
Second Rotary Meter installed September, 1908, 45,000 cu. ft. capacity per hour.

NORTH SHORE CONSOLIDATED GAS COMPANY
WAUKEGAN, ILL.

GEORGE F. GOODNOW
GENERAL MANAGER

August 14th, 1909.

Mr. E. C. Brown,
Prest. Rotary Meter Company,
280 Broadway, New York.

Dear Sir:

We have had in use since January 1907, one Rotary meter 60,000 cubic feet capacity per hour and since September 1908, another one 45,000 cubic feet capacity per hour. We have made a number of checks on these meters with a small gas holder and have been well satisfied with the correctness of registration. The small room necessary to install these meters of this capacity is a very desirable feature.

Yours truly,
NORTH SHORE CONSOLIDATED GAS COMPANY,

GFG-AH

By _____
General Manager.

One-half the cost—One-tenth the space of Old-Style Wet Meters.

When in need of Station Meters write

Rotary Meter Company,

280 Broadway, NEW YORK.

Our Literature will be sent on request.

ROTARY METER COMPANY

P. PLANTINGA, President W. E. STEINWEDELL, Secretary

THE GAS MACHINERY CO.,

Main Office and Shops

CLEVELAND, OHIO.

NEW YORK OFFICE, - - 56 PINE STREET.

COAL AND WATER GAS APPARATUS,
EXHAUSTERS, CONDENSERS, SCRUBBERS,
TAR EXTRACTORS, WASHERS, PURIFIERS,
VALVES, CONNECTIONS,
BY PRODUCT MACHINERY,
COMPLETE GAS PLANTS.

ROUND STEEL PURIFIERS WITH GATE AND DOUBLE SEATED REVERSING VALVE CONNECTIONS.

THE GAS MACHINERY CO.
CLEVELAND, OHIO.

DIDIER-MARCH COMPANY,

Hudson Terminal Building,

WORKS:
Keasbey, Perth Amboy, N. J.

50 Church Street,
NEW YORK, N. Y.

DESSAU SYSTEM OF VERTICAL RETORTS,

"The Only System in Successful Operation."

U. S. Patent No. 904043.
"Process Patent for the Carbonization of Coal in Vertical Retorts."

U. S. Patent No. 801268.
"Operating Mechanism for Bottom Mouthpieces."

U. S. Patent No. 906187.
"Feeding Device."

U. S. Patent No. 899503.
"Retort House."

U. S. Patent No. 915156.
"Recuperation."

388 Benches, with 3984 Retorts in operation and under construction.

TOTAL DAILY PRODUCING CAPACITY, 60,000,000 CUBIC FEET.

First Installation in the United States of America,

PROVIDENCE, R. I., 12 BENCHES, 120 RETORTS,

Complete, with

Retort House, Coal and Coke Handling Machinery and Storage Bins.

HORIZONTALS AND INCLINES OF APPROVED TYPES.

Correspondence Solicited. **FREDERICK J. MAYER, General Manager.**

WE STOP CLINKERS.

GETTING REPEAT ORDERS HAS ALWAYS BEEN CONSIDERED GOOD EVIDENCE OF SATISFACTORY MATERIAL, SUPERIOR WORKMANSHIP AND FAIR TREATMENT.

LET US PRESENT TO YOU THIS EVIDENCE, AND SHOW YOU THAT ALL OUR GUARANTEES ARE BEING REALIZED.

THREE BENCHES UNDER CONSTRUCTION.

—NEW BENCHES—REFILLINGS—
—HORIZONTALS—INCLINES—VERTICALS—

SOLE AGENTS FOR CENTRAL AND WESTERN STATES FOR DESSAU SYSTEM OF VERTICAL RETORTS.

THE IMPROVED EQUIPMENT COMPANY,

MAIN OFFICES: 60 WALL STREET, NEW YORK, N. Y.

SOLE LICENSEES FOR THE DOHERTY BENCH FUEL ECONOMIZER.

LONG DISTANCE TELEPHONE, 1503-D.

FRANK D. MOSES, President.

GAS ENGINEERING CO.,

MANUFACTURERS AND ERECTORS OF

COMPLETE GAS WORKS.

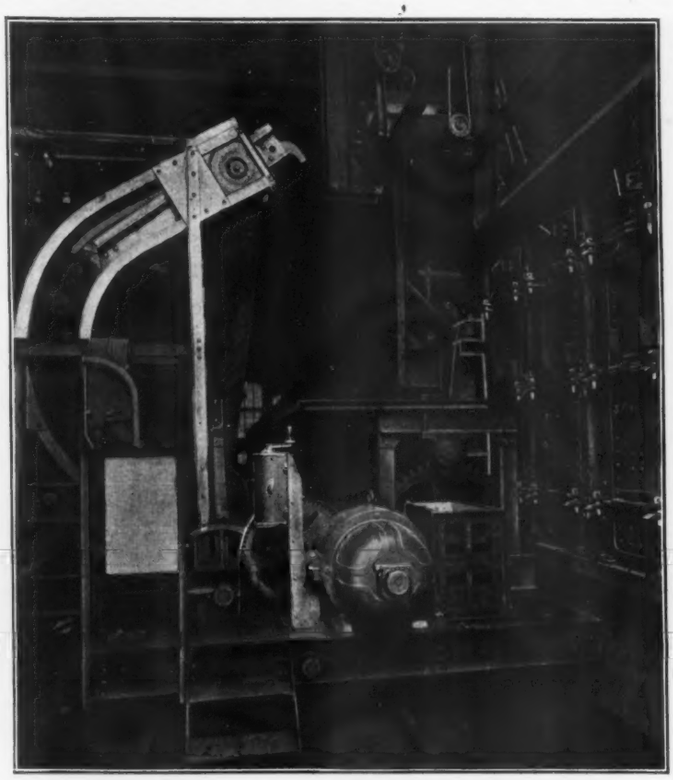
SPECIAL ATTENTION GIVEN TO LARGE PURIFIERS.

OFFICE AND WORKS, - - - - - - TRENTON, N. J.

CHAMBER OVENS.

Do You Know About Chamber Ovens?

Horizontal, Vertical, or Inclined.



If your output is over 250,000 feet per diem don't fail to consult

THE CHAMBER OVEN CO.,

405 Keene St.,

MILWAUKEE, WIS.

FRED. BREDEL, President.

WM. H. CAMPBELL, Eastern Agent,

Virginia State Insurance Building, Richmond, Va.

Horizontal Chamber Oven with four chambers. Capacity, 125,000 cubic feet per oven.

Mueller Pipe Jointers.

The question of fitting a Mueller Pipe Jointer to the pipe is merely a question of encircling the pipe with the band and tightening the clamp. It is all in one piece.

Mueller Pipe Jointers are made of a special grade of packing reinforced by a brass band to which the clamp is attached. They are made in sizes for pipe 2 to 72 inches.

Unconditionally Guaranteed.

TRADE MARK
MUELLER
REGISTERED

H. MUELLER MFG. CO.

Works and General Offices,
DECATUR, ILL., U. S. A.
West Cerro Gordo St.

Eastern Division,
NEW YORK, N. Y., U. S. A.
254 Canal St. (cor. Lafayette).

DUXBAK BELTING

Tests and Testimonials

ERNEST C. MOORE,
Civil Engineer,
Tribune Building, N. Y.

October 14th, 1908.

CHARLES A. SCHIEREN & CO.,
30 Ferry Street, N. Y. C.

Gentlemen:—

Replying to your inquiry as to your Duxbak Leather Belts, beg to say that I replaced several rubber belts in the Power House at Tompkins Place & Degraw Street, for the construction of the Gowanus Flushing Tunnel, with your Duxbak Leather Belts as follows:

August	13th, 1907	24" Belt	56 ft. long.
"	30th, "	26" "	59 ft. "
Sept.	26th, "	20" "	59 ft. "
March	14th, "	5" Short Belt.	

These belts have all been running where there was considerable water and also considerable grease, and they have given entire satisfaction.

Yours truly,
E. C. MOORE.

JUGHARDTS' CUSTOM LAUNDRY,
Est. 1885,
W. G. JUGHARDT,
394, 396 and 398 Myrtle Ave.,

BROOKLYN, Oct. 16, 1908.

CHAS. A. SCHIEREN COMPANY,
30 Ferry St., New York.

Gentlemen:—

I have used your belting for several years and since you introduced your Duxbak waterproof belt I have bought several for work on Extractors and Washers with very satisfactory results.

My main belt is also a Duxbak Waterproof belt and is in operation where the belt is in contact with oil as well as dampness.

I am glad to testify to the merits of your Duxbak belting, and remain,

Yours truly,
(Signed) W. J. JUGHARDT.

GENERAL STORAGE BATTERY COMPANY

BOONTON, N. J., Oct. 7th, 1908.

Subject: Belting
File No.: 818
THE CHAS. A. SCHIEREN CO.,
30 Ferry St., New York.

Gentlemen:—

Concerning the inquiry for our 22" double perforated "Duxbak" leather belting which you supplied us in Nov., 1906, in the flume house over the tail race. It has given us no trouble of any sort. There is no noticeable slippage on the pulley, although the room is very damp due to the sweating of the flume and more or less water around on account of the location over the tail race. We do not experience any noticeable difficulty due to the moisture.

Yours truly,
GENERAL STORAGE BATTERY CO.,
Per J. Lansing,
M.E. in charge of factories.

JL/EV

"Duxbak" Belting is sold with a return-your-money guarantee that protects the buyer against defects in leather or workmanship and damage by water.

Chas. A. Schieren Company
ESTABLISHED 1868

NEW YORK, 30-38 Ferry St. (Gas Dept.)
CHICAGO, 84-86-88 Franklin St.
BOSTON, 641 & 643 Atlantic Ave. (Opposite South Station).
PHILADELPHIA, 226 North 3d St.
PITTSBURG, 208 Wood St.
DENVER, 1622 Wazee St.
BROOKLYN, N. Y., Cor. 13th St. and 3d Ave.
HAMBURG, GERMANY, Auf dem Sande 1.
OAK LEATHER TANNERIES, Bristol, Tenn.

THE PARKER-RUSSELL MINING AND MFG. CO.,

Saint Louis, Missouri. **New York Office, 45 Broadway.**

Gas Retort Benches.
Longest life—largest output per retort—lowest fuel results—greatest ease of operation.
Water Gas Linings.
Fiddes-Aldridge Discharging Charger.
Large stock of retorts and settings on hand.
All our wares are manufactured at our own plant from clays mined at our mines.

All contracts made as of St Louis. Correspondence Solicited.

THE HUMPHREY GAS ARC LAMP,

Designed, Developed and Distinguished as

"THE GAS COMPANY'S LAMP,"

Has been one of the most conspicuous successes of the past decade in lighting lines. The competing lamps that were brought out in scores during the earlier days had but a brief life and exist to-day principally as unpleasant memories of ill-considered purchases. **Is not the same thing about to be repeated with Inverted Gas Arc Lamps?**

Adopt the **Humphrey Inverted** as your standard and be insured and protected by the strongest, most liberal and progressive gas lighting organization in the world.

GENERAL GAS LIGHT CO.,

Kalamazoo. New York. San Francisco.
London, England. Bremen, Germany. Wellington, New Zealand.

PRACTICAL HANDBOOK ON

GAS ENGINES,

With Instructions for Care and Working of the Same,

By G. LIECKFELD, C.E.

Translated with Permission of the Author, GEO. M. RICHMOND, M.E.

PRICE, $1.00.

FOR SALE BY

AMERICAN GAS LIGHT JOURNAL, 42 Pine St., New York City.

Whether you buy Ironclads or not, you owe it to yourself to investigate them.

We could make a cheaper meter than the Ironclad -- but we would then have competition.

Ironclad CAST IRON DRY Gas Meters

The accuracy, durability and uniformity of Ironclad Meters is the result of years of careful and costly experimenting by the most able engineers, to produce a meter that would meet the requirements of gas companies whether their gas be

NATURAL, ARTIFICIAL OR ACETYLENE.

All the care, skill and experience put into the manufacture of the Ironclad Meter is not a matter of additional cost--TO YOU. We would rather do the experimenting in our factory than leave it for you to do.

CATALOG 100 FREE

Pittsburg Meter Company

NEW YORK, 149 Broadway.
CHICAGO, 256 Madison Street.
KANSAS CITY, 6 West Tenth Street.
MINNEAPOLIS, 409-411 Second Avenue, S.

General Office and Works,
East Pittsburg, Pa.

MANUFACTURERS OF GAS METERS AND WATER METERS.

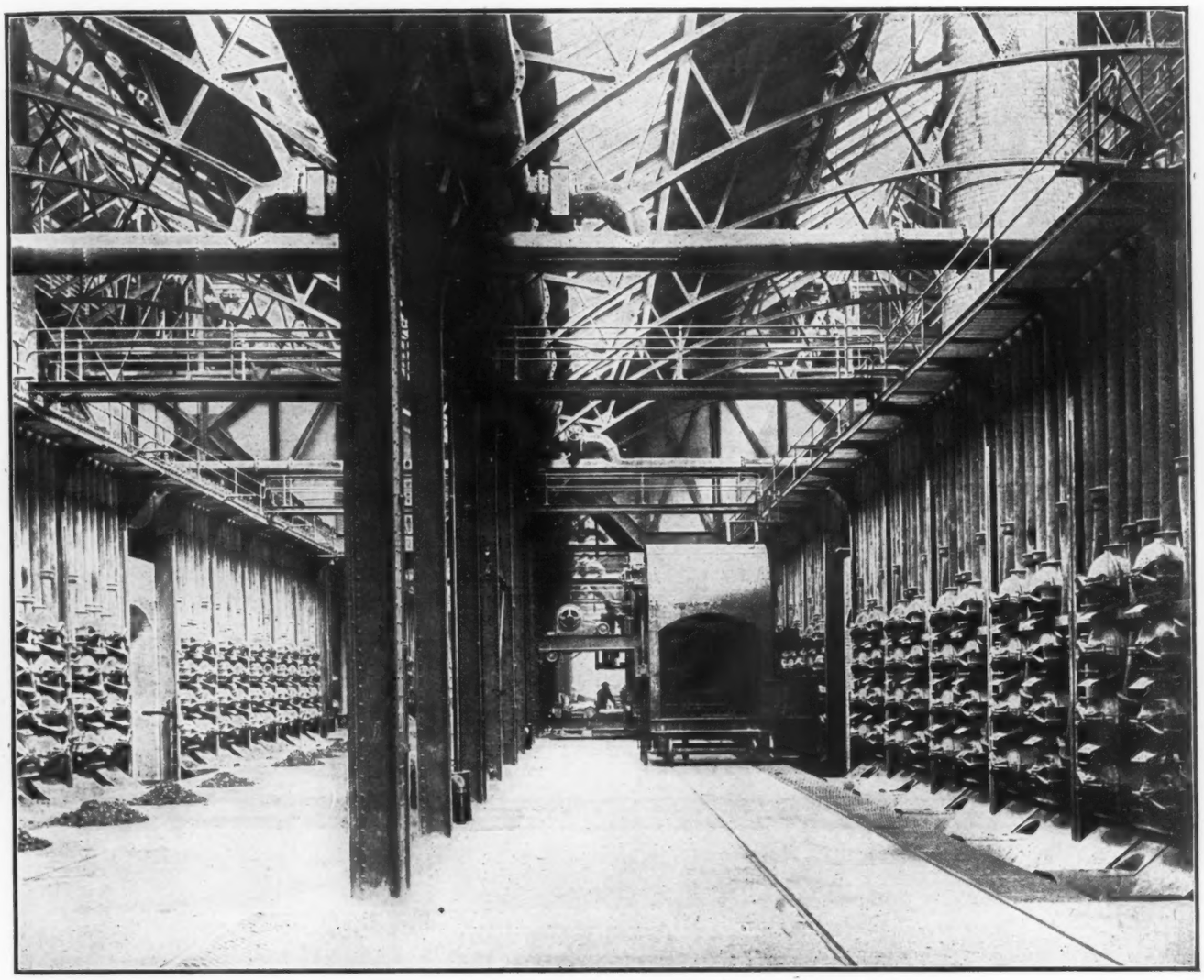


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PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

COMPLETE COAL GAS PLANTS.

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BUILDERS OF
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CONDENSERS,
SCRUBBERS,
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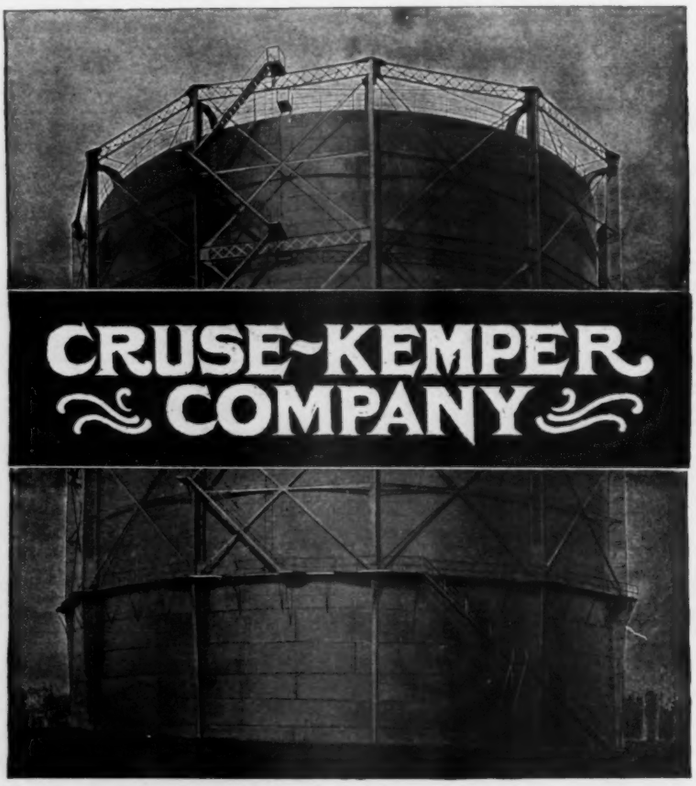

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STEEL BUILDINGS and ROOF TRUSSES.
STRUCTURAL IRON & STEEL WORK IN GENERAL.

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ISBELL-PORTER COMPANY

GAS ENGINEERS & BUILDERS OF GAS WORKS

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CHARGING AND DISCHARGING MACHINERY
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PRIMARY AND SECONDARY CONDENSERS FOR FRESH OR SALT WATER

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TAR EXTRACTORS
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ROTARY AMMONIA SCRUBBERS
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BRIDGE & OGDEN STREETS
NEWARK, N. J.
ESTABLISHED 1865

GAS EXHAUSTERS AND BLOWERS.

We have a full line of sizes for all standard pressures. The design, material and workmanship is A-1. Prompt Delivery and Reasonable Prices. WHY NOT give us YOUR requirements?

THE PIQUA BLOWER CO.,

PIQUA, OHIO.

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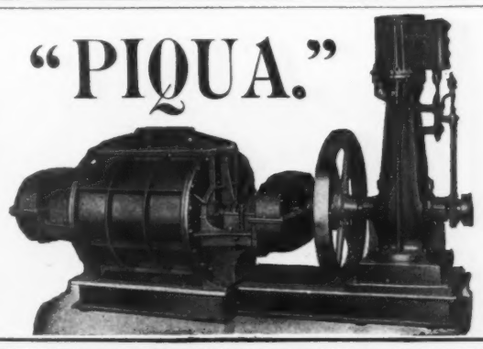

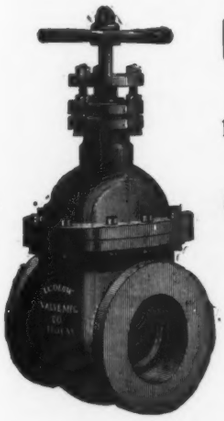

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Double and Single Gate Valves, ¼" to 72",

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HOT GAS VALVES A SPECIALTY.

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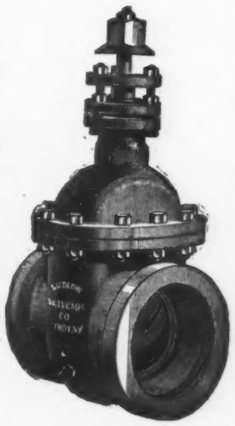

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Foot of Twelfth Street and East River, New York,

BENCH WORK,
CONDENSERS,
SHAVING SCRUBBERS,
CAST IRON FLANGED PIPE,
RIVETED STEEL PIPE.

FREDERICK W. FLOYD, Engineer.

ESTABLISHED 1856.

HENRY MAURER & SON,

Manufacturers of

High Grade Firebrick, Blocks, Tiles,

ETC.,

Works: Maurer, N. J. Office: 420 E. 23d St., N. Y. City.

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GAS BENCH CONSTRUCTION CO.

ST. LOUIS, MO.

ENGINEERS AND BUILDERS

OF COAL GAS BENCHES

"BETTER BENCHES"

All Workmanship, Material and Results Guaranteed.

16 YEARS EXPERIENCE DESIGNING, BUILDING AND OPERATING BENCHES

All Retorts and Settings Manufactured under the supervision of Our Own Chemist and Engineer

We make a special High Grade Water Gas Lining Material and Checker Brick

PRACTICAL HANDBOOK ON GAS ENGINES, WITH INSTRUCTIONS FOR CARE AND WORKING OF THE SAME,

By G. LIECKFELD, C.E. Translated with Permission of the Author, by GEORGE M. RICHMOND, M.E. Price, $1.

For Sale by AMERICAN GAS LIGHT JOURNAL, 42 Pine Street, New York City.

GAS BLAST FURNACES

—AND—

HEATING MACHINES

—FOR—

INDUSTRIAL PURPOSES.

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AMOUNT
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Star Retorts.

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ENGINEER GAS WORKS DIVISION:
A. S. B. LITTLE.

The "Gas World" Analyses of Municipal Gas Accounts, FOR 1907-1908,

AND

The "Gas World" Analyses of Gas Companies' Accounts, FOR 1908.

The former showing at a glance 69 accounts and the latter 55 accounts of Coal and Water Gas Companies, itemized under

Coal Carbonized, Gas Made and Sold, Yield of Residuals, Public Lamps, Mileage of Mains, Consumers, Price of Gas, Illuminating Power, Financial Results, Revenue.

Manufacturing Charges, Rates and Taxes, Distribution Charges, Management Charges, Bad Debts, Capital Paid Up, Capital per Ton and per Thousand, Reserve Funds, etc.

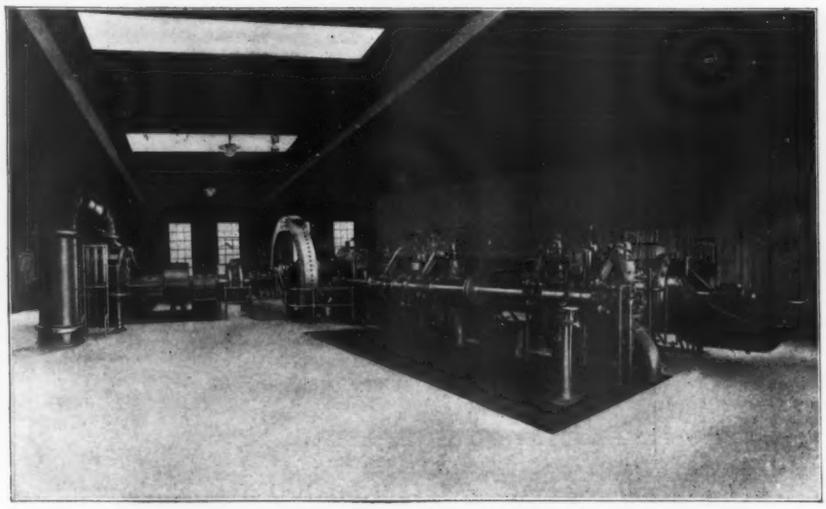
EVERY GAS ENGINEER AND MANAGER SHOULD HAVE A COPY OF THIS INVALUABLE AND UP-TO-DATE WORK.

Price, $4 each. For Sale by AMERICAN GAS LIGHT JOURNAL, 42 Pine Street, New York City.

1859. FIFTY YEARS. 1909.

ROOTS' EXHAUSTERS.

A half century of experience, up-to-date engineering and shop facilities embodied in these **World Famous Gas Exhausters.**



An Installation for the Peoples Gas Light and Coke Co., Chicago, Ill., handling 1,000,000 cu. ft. per hour, under six (6) pounds per square inch.

P. H. & F. M. ROOTS COMPANY,

HOME OFFICE: Connersville, Ind. NEW YORK OFFICE: 120-122 Liberty St. CHICAGO OFFICE: 1547 Marquette Bldg.

SEND FOR POCKET EDITION OF "ENGINEERS' PRACTICAL REFERENCE BOOK."

IT IS ABSOLUTELY NECESSARY

that people be reminded continually that you are ready to sell them the things they want. This is a big world, with lots of people in it, and you are easily forgotten if you don't keep buyers posted. What you should do is to tell them about your product to-day, remind them to-morrow, and keep on reminding them thereafter. If you do this, when the buyer is ready to place his order he will remember you. :: :: :: :: :: :: :: :: :: ::

An Advertisement in the AMERICAN GAS LIGHT JOURNAL

is the best and surest means of keeping your name and product before the buyers. :: ::

BRAY BURNERS HAVE BEEN USED FOR MORE THAN FORTY YEARS.

In that time they have been recommended and used by the leading gas experts, endorsed by the U. S. Government Inspectors of Gas, as well prominent State Inspectors.

To-day the Bray is the only high-grade, absolutely reliable open flame burner on the market.

W. M. CRANE COMPANY,

16, 18 and 20 West 32d Street, New York,

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MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

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Also, FLANGE PIPE, LAMP POSTS, Etc.

TRADE MARK

BRISTOL'S

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RECORDING GAUGES

For All Commercial Ranges of

PRESSURE AND VACUUM.

Write for New Preliminary Bulletin No. 104.

BRANCH OFFICES: { New York. Chicago.

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EVERYONE INTERESTED IN GAS MATTERS

Should have a Copy of our 50th Anniversary Number (Price, 50c.), Containing the Following Articles:

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Gas Association Work and its Influence in and on the Gas Industry for the Last Half Century. George G. Ramsdell.

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Fifty Years of Street Lighting in the City of New York. H. Thurston Owens.

Historical Notes Respecting the Development of the Last Half Century in the Gas Business of the Pacific Coast. John A. Britton.

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Progress of the Gas Industry of Great Britain in the Last 50 Years. N. H. Humphrys.

Gas Coals of America. James D. Perkins.

A Half-Century History of Water Gas. F. N. Morton.

The Development of the Public Utilities Commissions as Applied to the Gas and Electric Business. C. J. Russell Humphreys.

A Half-Century's History of Gaseous Fuel as Applied to Heating Gas Retorts. F. Bredel.

Systems of Vertical Retorts. Fred. J. Mayer.

Development of the Ammonia Industry in Gas Works during the Last 50 Years. R. W. Hilgenstock.

Residuals, Some History of. Carroll Miller.

Meters and Meter Makers. D. McDonald.

Progress in Electric Current Development in the Artificial Lighting Field. A. F. Ganz.

Development of the New Business Division of the Gas Industry during the Last 50 Years. Philmer Eves.

Growth and Value of Demonstration Work in the Household of Gaseous Fuel. Helen Armstrong.

"Uncle Jerry" in Reminiscent Mood. J. B Howard.

Present-Day Photometrical Practice. W. H. Gartley.

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ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 cents. Orders may be sent to

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Alcohol, its Manufacture from Farm Products and De-Naturing. By F. B. WRIGHT.

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AMERICAN METER CO.,

NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

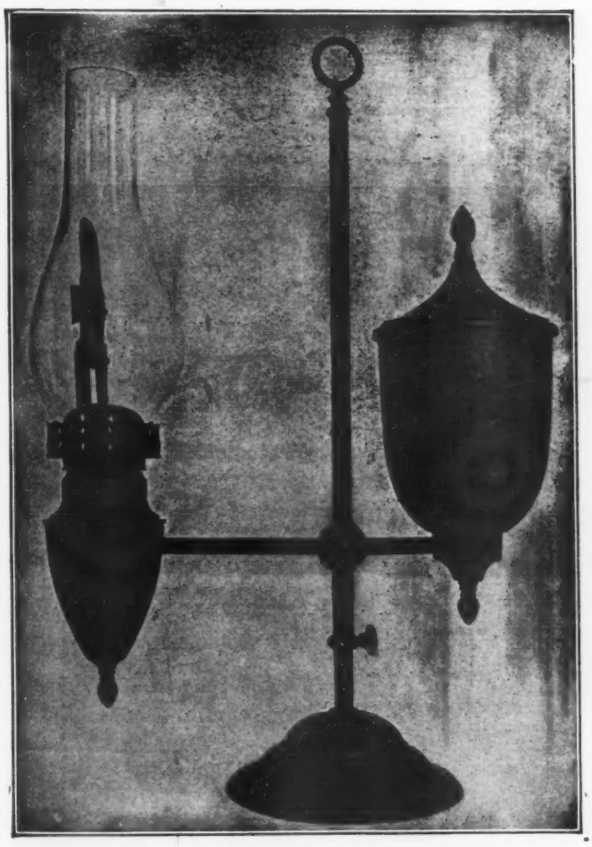
SEPTEMBER, 1909.

Day of Week.	Date.	Table No. 1. FOLLOWING THE MOON. Light.	Extinguish.
Wed.	1	7.00PM	8.50PM
Thu.	2	7.00	9.20
Fri.	3	7.00	9.50
Sat.	4	7.00	10.20
Sun.	5	6.50	11.00
Mon.	6	6.50LQ	11.40
Tue.	7	6.50	12.30AM
Wed.	8	6.50	1.20
Thu.	9	6.50	2.20
Fri.	10	6.50	3.20
Sat.	11	6.50	4.40
Sun.	12	6.40	4.40
Mon.	13	6.40	4.40
Tue.	14	6.40NM	4.40
Wed.	15	6.40	4.40
Thu.	16	6.40	4.40
Fri.	17	6.40	4.40
Sat.	18	6.40	4.40
Sun.	19	7.40	4.50
Mon.	20	8.10	4.50
Tue.	21	8.50	4.50
Wed.	22	9.40FQ	4.50
Thu.	23	10.30	4.50
Fri.	24	11.40	4.50
Sat.	25	12.50AM	4.50
Sun.	26	2.10	4.50
Mon.	27	3.20	4.50
Tue.	28	No L.	No L.
Wed.	29	No L.FM	No L.
Thu.	30	No L.	No L.

TOTAL HOURS DURING 1909.

By Table No. 1.

	Hrs.Min.
January	212.20
February	183.40
March	173.00
April	151.10
May	144.10
June	138.50
July	145.40
August	160.30
September	180.00
October	201.00
November	216.30
December	233.40
Total, yr.	2140.30



THE ELLIOTT KEROSENE STANDARD PHOTOMETER LAMP.

❋❋❋

10-Candle Power.

❋❋❋

This lamp is a perfect substitute for the 10-candle Pentane Lamp hitherto used, and has the following advantages:

1st. It uses Standard Kerosene Oil (Pratt's Astral Oil or equivalent).

2d. It is remarkably steady. Will burn 24 hours continuously with less than 2 per cent. variation.

3d. It is much less dangerous than Pentane, which is a kind of gasolene.

4th. It is not easily affected by air currents in the photometer room.

5th. Since the lamp may burn continuously, the candle power of gas may be taken at any moment, if necessary. This insures steady illuminating power without waste of carburetting material.

6th. The first cost of the lamp brings it within the reach of even small gas works.

7th. Costs much less to maintain than a Pentane lamp or sperm candles doing the same service.

8th. Is not affected by the weather.

PUBLIC LIGHTING TABLE.

SEPTEMBER, 1909.

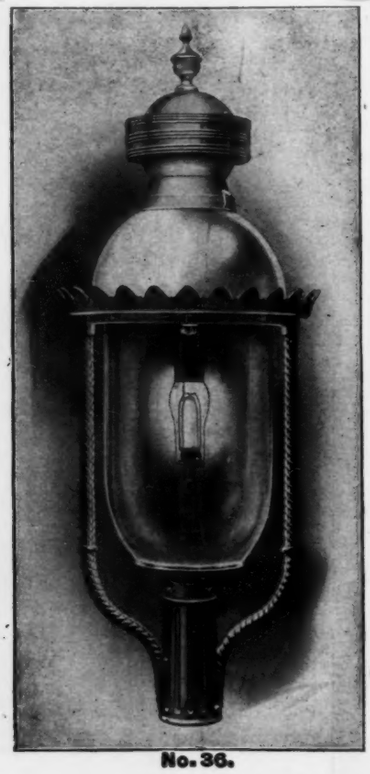
Day of Week.	Date.	Table No. 2. NEW YORK CITY. All Night Lighting. Complete Lighting in One Hour From Time Given P. M.	Complete Extinguishing in 50 Minutes From Time Given A. M.
Wed.	1	6.27	3.57
Thu.	2	6.27	3.57
Fri.	3	6.17	4.07
Sat.	4	6.17	4.07
Sun.	5	6.17	4.07
Mon.	6	6.17	4.07
Tue.	7	6.12	4.07
Wed.	8	6.12	4.07
Thu.	9	6.12	4.07
Fri.	10	6.02	4.17
Sat.	11	6.02	4.17
Sun.	12	6.02	4.17
Mon.	13	6.02	4.17
Tue.	14	6.02	4.17
Wed.	15	6.02	4.17
Thu.	16	6.02	4.17
Fri.	17	5.52	4.27
Sat.	18	5.52	4.27
Sun.	19	5.52	4.27
Mon.	20	5.52	4.27
Tue.	21	5.47	4.27
Wed.	22	5.47	4.27
Thu.	23	5.47	4.27
Fri.	24	5.37	4.37
Sat.	25	5.37	4.37
Sun.	26	5.37	4.37
Mon.	27	5.37	4.37
Tue.	28	5.32	4.37
Wed.	29	5.32	4.37
Thu.	30	5.32	4.37

TOTAL HOURS DURING 1909.

	Hrs.Min.
January	428.30
February	358.15
March	353.10
April	298.10
May	263.20
June	234.45
July	248.30
August	278.00
September	311.25
October	370.05
November	397.40
December	438.35
	3980.25
Deduct on account of 50 min. extinguishing time	30.25
Total, yr.	3950.00

NEW YORK, 318 West 42d Street. BOSTON, 820 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, 218 La Salle Street. SAN FRANCISCO, 512 Oak Street.

WELSBACH STREET LIGHTING COMPANY



No. 36.

....OF AMERICA....

Controls and Operates the **Welsbach System of Street Lighting,**

Which includes its specially DESIGNED and PATENTED BURNER for PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

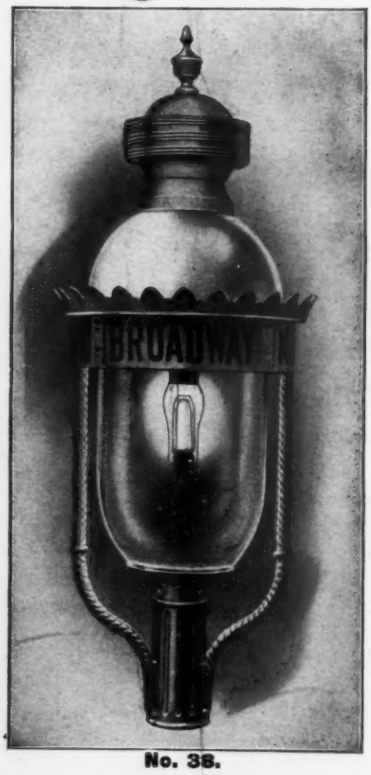
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.



No. 38.

Welsbach Inverted Portico Lamps

No. 901. INVERTED PORTICO LAMP. Single Burner.

For all semi-exposed places—porticos, entrances, etc. simple in construction, few parts; exterior made of enameled steel, interior parts of heat-resisting material that are practically indestructible. Wind, storm and insect proof.

The globes on designs No. 901 and No. 902 are supported in a flanged reflector that provides for heat expansion. The reflector being hinged, it can readily be lowered for cleaning or trimming the lamp.

Gas and pilot-flame adjustment by means of needle valves from outside of lamp. The pilot-flame is protected and will not blow out.

Three Styles from which to Choose:

No. 902.

Equipped with No. 5 clear globe and steel enameled reflector 8⅜ inches in diameter and 1½ inches deep. Finish, dark green enamel.

Dimensions: Length over all, 16 inches; diameter of globe, 5 inches; depth of globe, 4 inches. List price, complete, without mantles... $8.00

No. 900.

Equipped with 7 inch alabaster or sand-blast ball globe. Finish, dark green, or white and gold enamel. Dimensions: Length over all, 17½ inches.

White and gold enamel. List price, without mantles..... $9.00

Dark green enamel. List price, without mantles..... $8.00

No. 901.

Same as 902 portico lamp, except steel enameled reflector, which is flat, and 10 inches in diameter.

List price, complete, without mantles..... $8.00

WRITE FOR DISCOUNTS.

WELSBACH COMPANY,

Gloucester, N. J. —FACTORIES— Columbus, Ohio.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

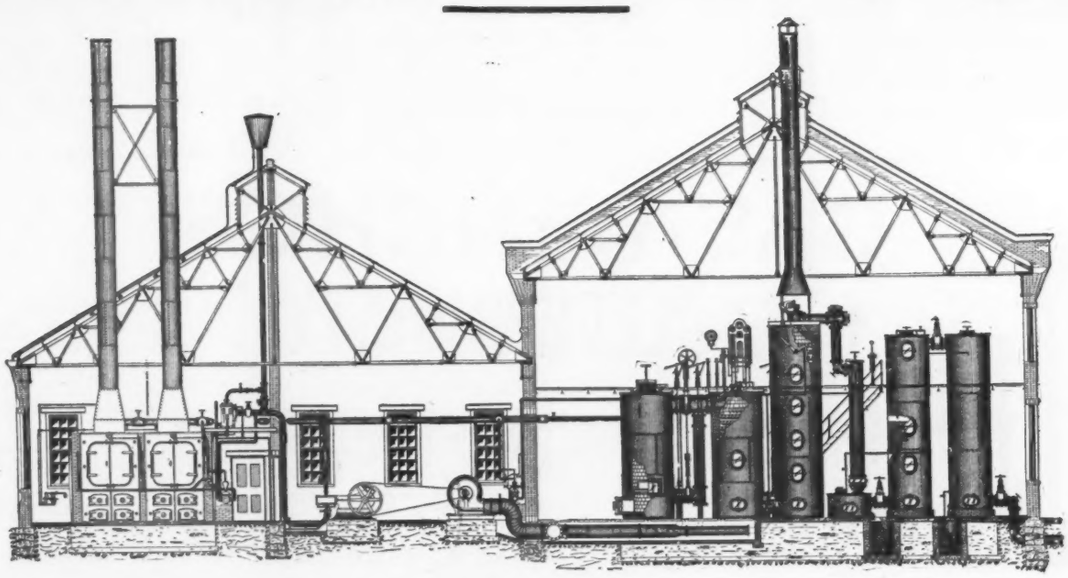
LESSEES, OPERATORS AND BUILDERS OF **GAS WORKS.**

Largest Builders of CARBURETTED WATER GAS PLANT IN AMERICA.

SOLE AMERICAN BUILDERS

OF THE

Standard Double-Superheater Lowe Water Gas Apparatus.



TOTAL SETS INSTALLED TO JULY 1, 1909, ... 704
TOTAL DAILY CAPACITY TO JULY 1, 1909, ... 577,440,000 cu. ft.

Tar Extractors for Carburetted Water Gas.
Photometrical Apparatus.
Gas Analysis Apparatus.
Recording Gauges.
Straight Standpipe System for Coal Gas Retorts.
Straight Standpipe Cleaners.
Waste Heat Boiler.
Hygrometer.
Meters for Regulating Air and Steam Supply to Water Gas Apparatus.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES, FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

GEROULD'S IMPROVED RETORT CEMENT.

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. NEW CASTLE, PA.

In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 300 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD,
29 North Mill St., New Castle, Pa.

KRATER-DINAS RETORT CEMENT.

Universally accepted to be the best cement for patching and repairing retorts, making up bench work, etc. Advantages: Powdered form; only mix with water; no waste; too much mixed, apply water and use the next time; adheres very easy; does *not* fall out by decarbonization. We guarantee or take back. Many re-orders and recommendations from America, Germany, France, Belgium, etc. Write for price and testimonials.

STRASSBURGER BROS., Sole Importers,
563 Lincoln Avenue, Chicago, Ills.

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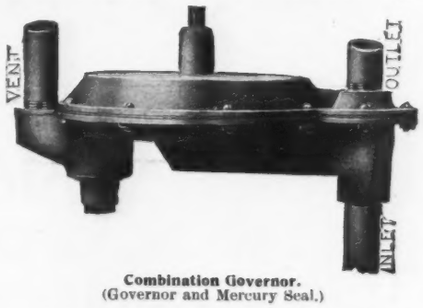

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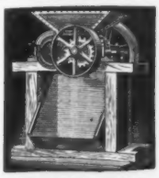

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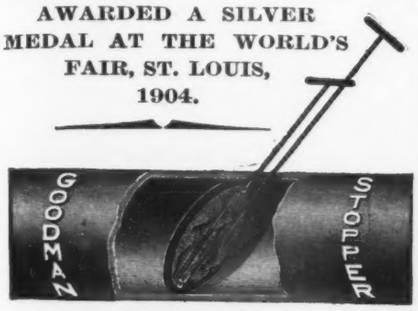

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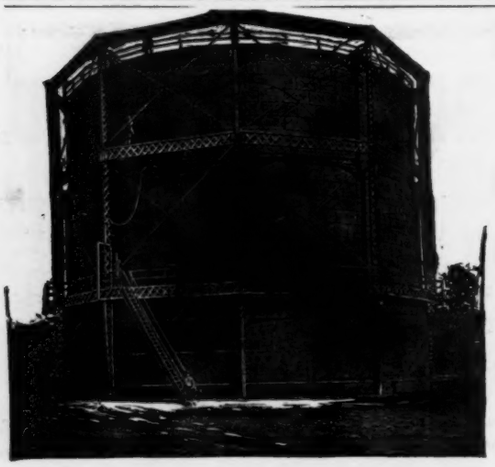

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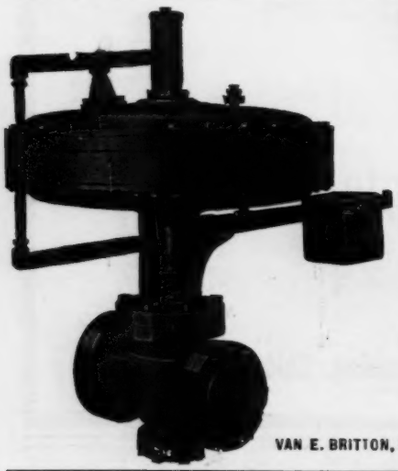

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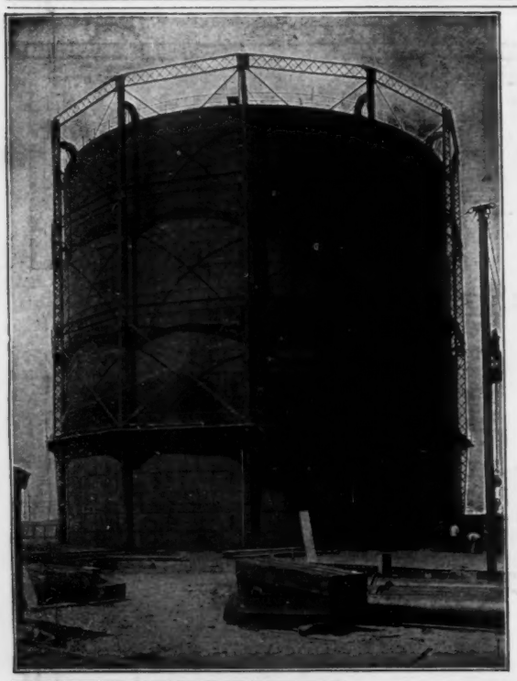

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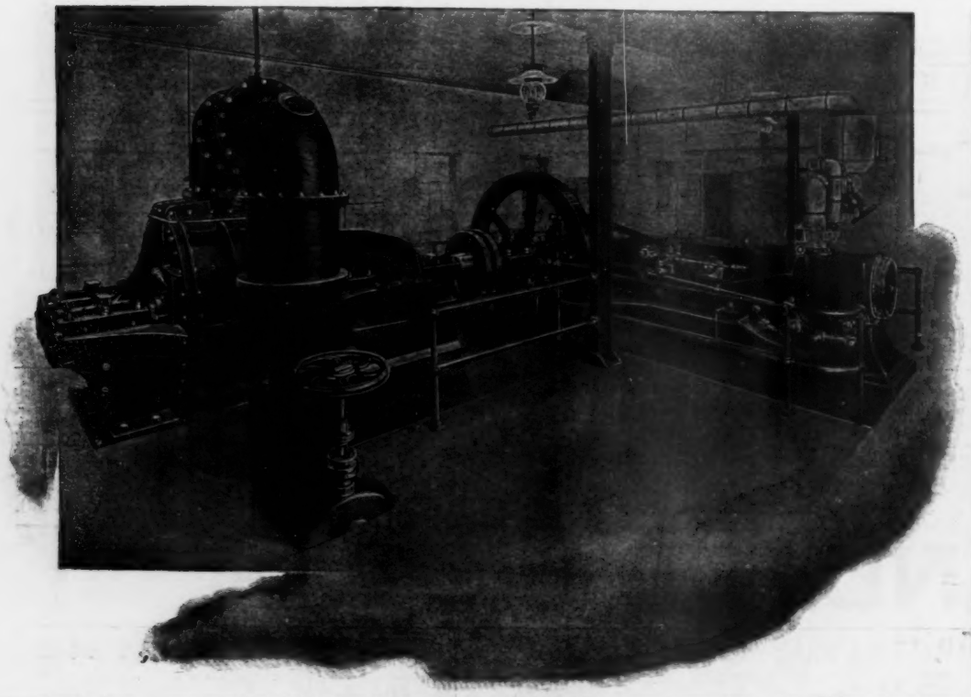

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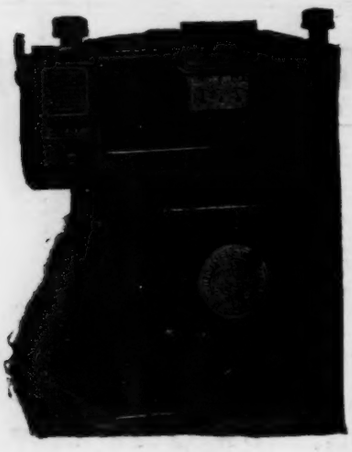

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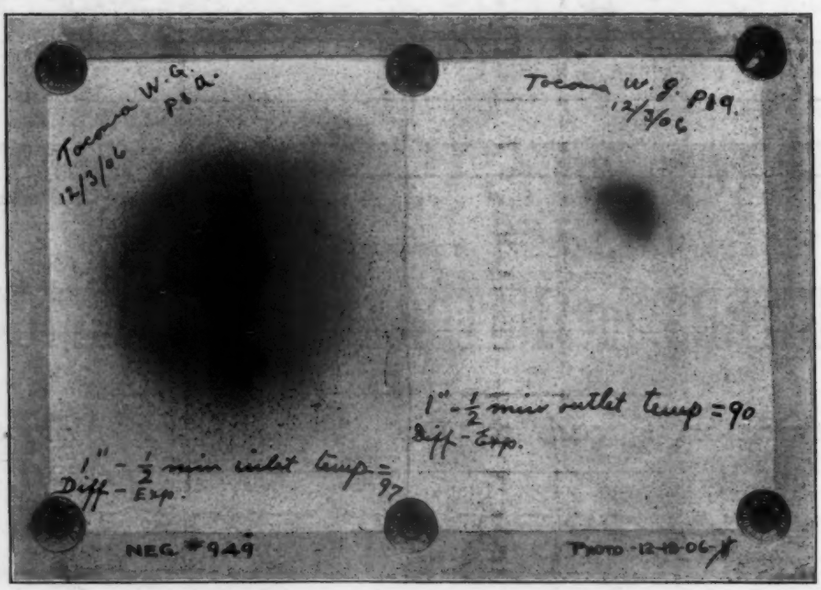
SOME CLASS
TO OUR
P. & A. TAR EXTRACTORS.



NOTICE HOW THEY DO
THE BUSINESS.

CONTRACTORS AND BUILDERS
EVERYTHING FOR A GAS PLANT